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ENGINEERING NEWS-RECORD

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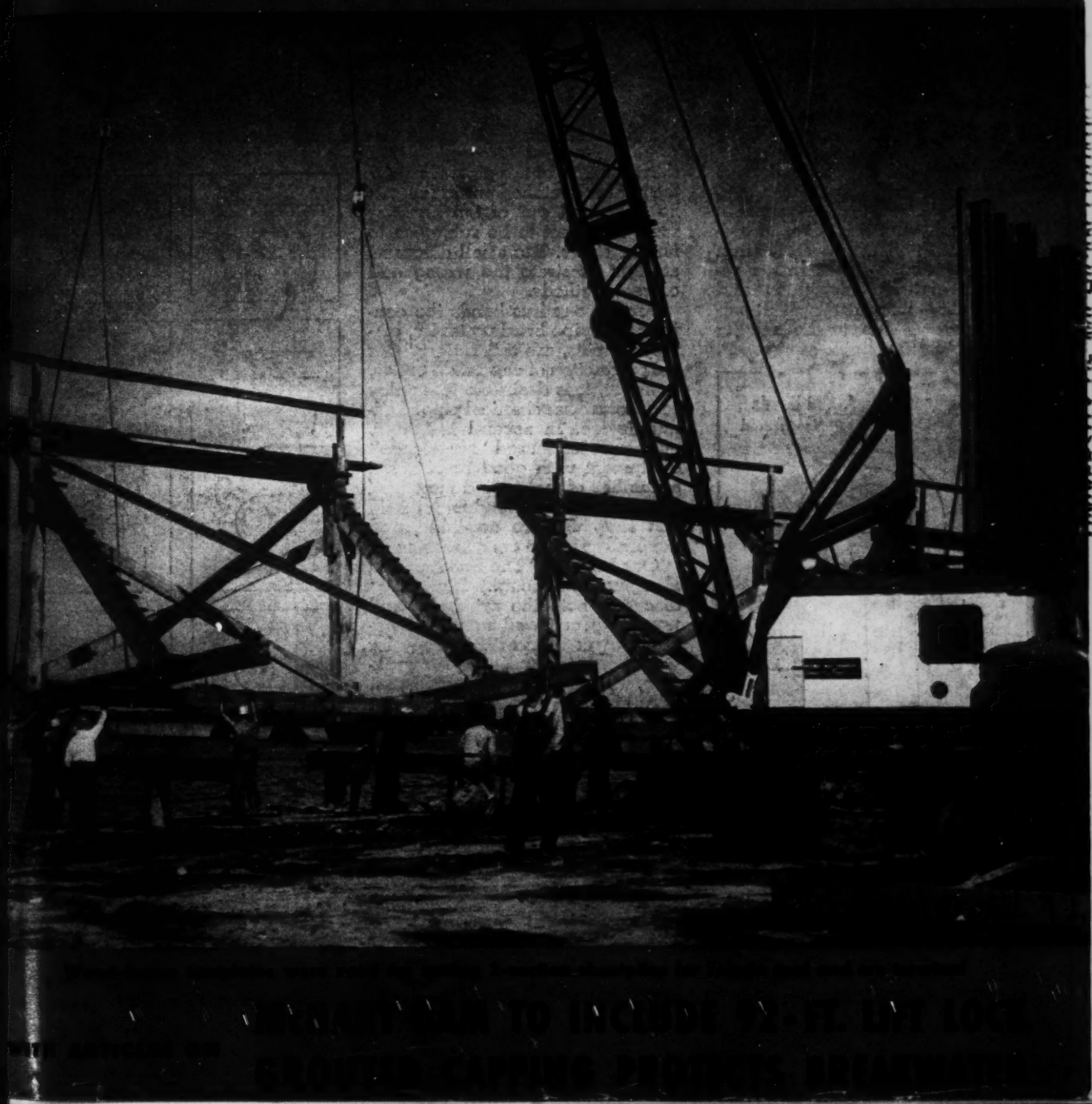
SEPTEMBER 30, 1948



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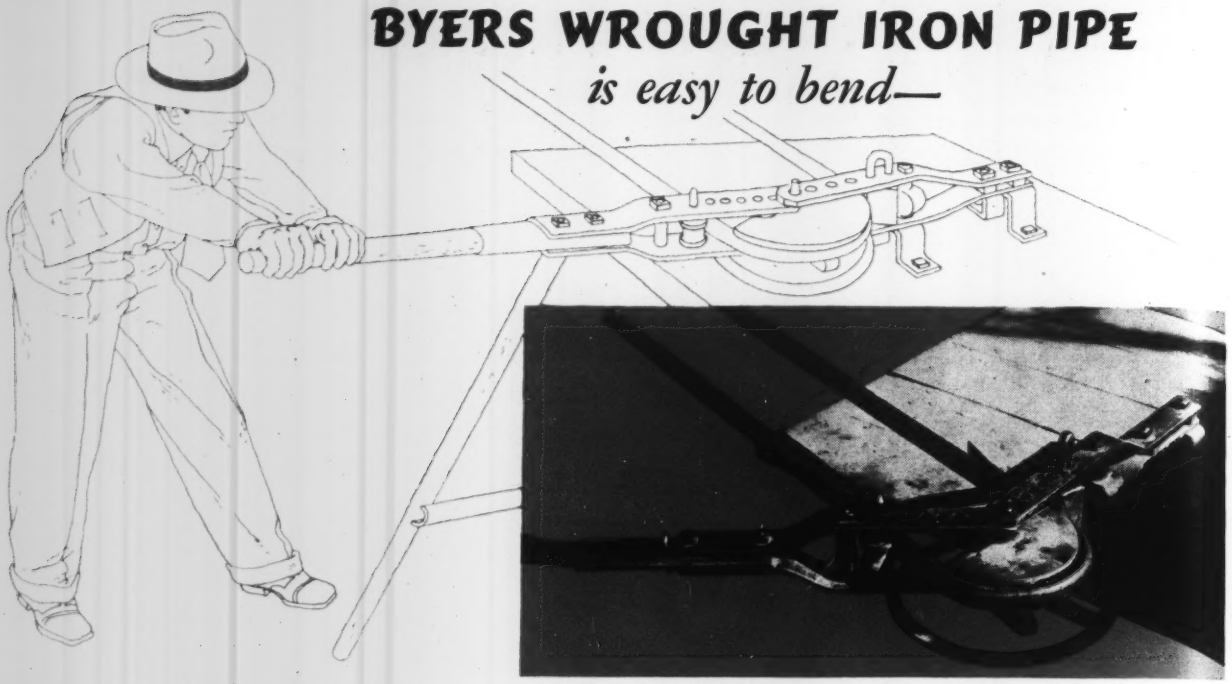

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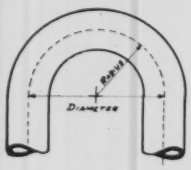

Size of Pipe	Minimum Radius of Bend Standard Weight	Extra Strong
3/8"	1.10"	1.10"
1/2"	1.40"	1.40"
3/4"	1.75"	1.75"
1"	2.15"	2.15"
1 1/4"	2.75"	2.75"
1 1/2"	3.50"	3.10"
2"	5.50"	4.60"

The minimum bend radii recommended for various sizes of Byers Wrought Iron pipe, both standard weight and extra strong, are shown in the table.

In bending wrought iron pipe, three fundamental requirements should be observed. (1) The force should be applied as a slow, steady pressure—to permit the material to flow. (2) The bending stress should be applied successively to short sections of the pipe. And, (3) the bent or stretched portion should be advanced *out* of the bending zone, so as not to be subjected to further stress. The small diagrams at right illustrate the wrong and correct methods.

For large-radius bends the conventional pipe bending tables, employing pins, are satisfactory. For the production of close radii bends, however, it is desirable to employ some form of mechanical pipe bending device. In several instances, customers have used "homemade" equipment with good results, but a number of makes and models of inexpensive pipe benders for field and shop use are available, and generally prove a good investment.

Our bulletin, "The Bending and Flanging of Wrought Iron Pipe" discusses both the principles and practice of cold and hot pipe bending. If you would like a copy for your file, or to pass on to your workmen, we will be glad to supply you.

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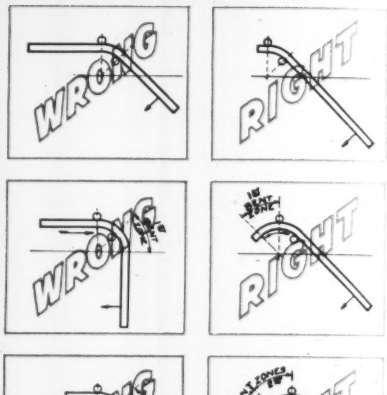

Here original bent sections are stressed when successive bends are made.

Here bent sections advance out of bending zone, are not subjected to further stress.

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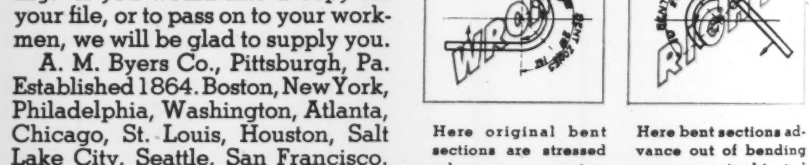

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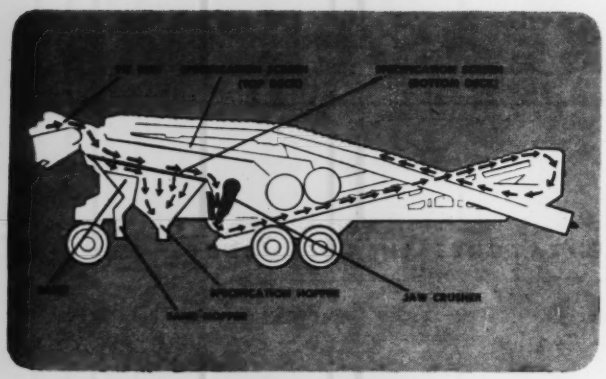

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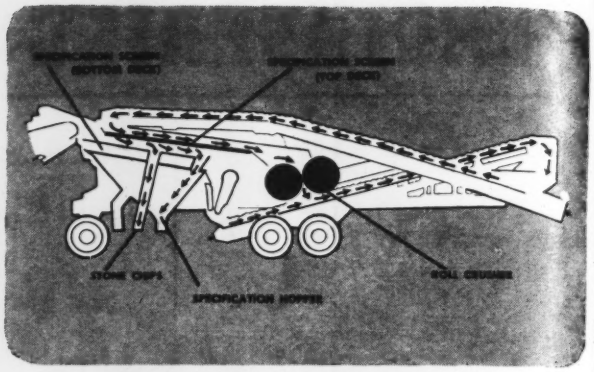

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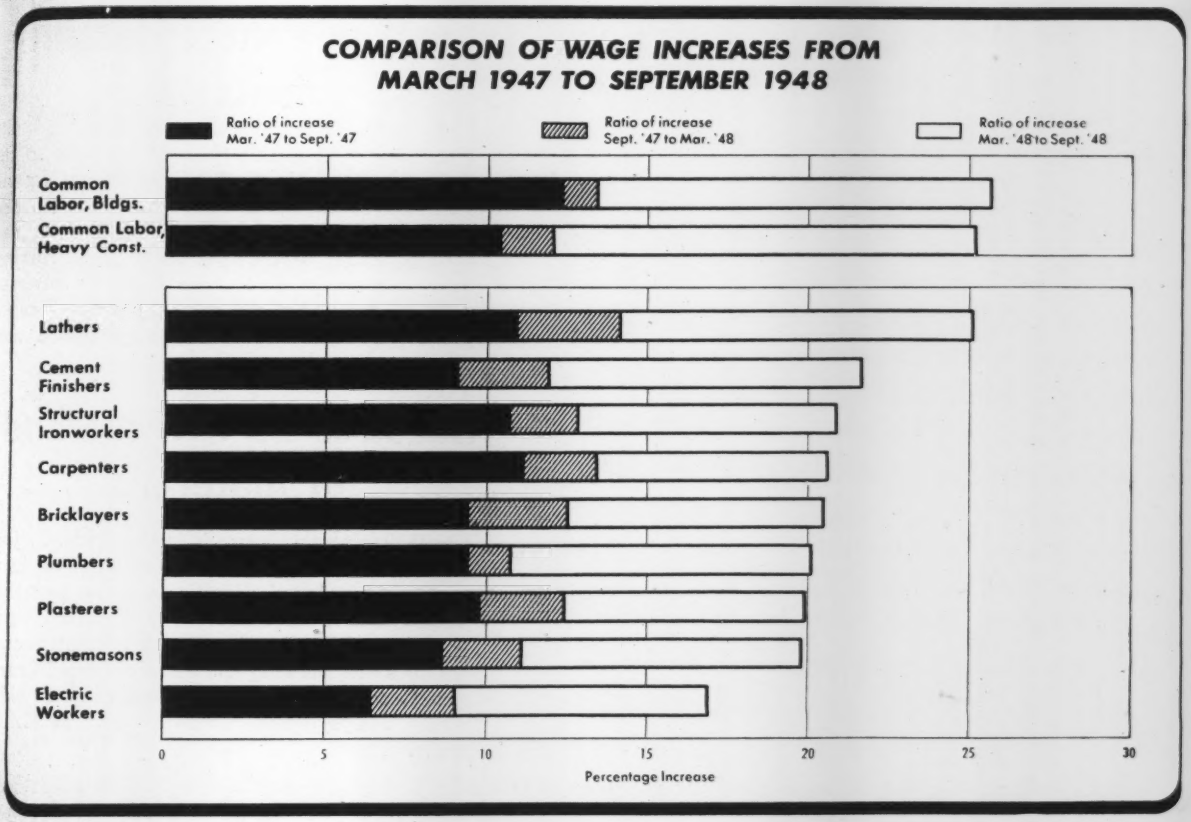

*Construction Wage Increases Slow Down

Skilled construction hourly wage rates rose 7.6 percent in the past six months, from March 1 to September 1, compared with a 9.6 percent increase in the corresponding six-months period a year ago. Wages of common construction workers in the same period of 1948 rose 10.8 percent, compared with an 11.3 percent increase in 1947, according to a recent survey made by *Engineering News-Record* of hourly wages in 40 major U. S. cities where comparable rates were available.

Although new construction wage agreements are generally negotiated in the spring of each year, some increases occur later in the year. Skilled wages rose 2.4 percent from September 1, 1947 to March 1, 1948 and common wages, 1.7 percent. There is some prospect for increases before wage contracts expire in the spring of 1949. Fifteen of the 66 cities surveyed indicate that some increases may occur before next spring, and three cities, Atlanta, Ga., Providence, R. I., and Tacoma, Wash., indicate that many changes may be expected. In Providence, electric workers, plasterers, plumbers, steamfitters and sheet metal workers are due for an increase in October or November and in Tacoma, increases can be expected about the first of the year.

In all other instances the increases expected are only for isolated trades in the individual cities such as bricklayers in Jacksonville and San Francisco, electricians in St. Louis, carpenters in Fort Worth and structural ironworkers and hoisting engineers in Norfolk.

In comparing wage increases for the past eighteen months, common wages on buildings and heavy construction showed the greatest increase, rising 25.7 percent and 25.2 percent, respectively.

Of the individually listed skilled trades, lathers showed the greatest rise, 25.1 percent from March 1, 1947 to September 1, 1948, following closely the increases for common labor. Increases for the remaining trades ranged from 16.9 percent for electric workers to 21.7 percent for cement finishers.

The supply of skilled labor as surveyed by *Engineering News-Record*, is still inadequate for construction needs with 47 of the 66 reporting cities indicating shortages. A shortage of bricklayers is reported for 24 cities, of plasterers for 9 cities. Other skilled labor shortages may be found among carpenters, plumbers, cement finishers and lathers. Common labor supply is adequate, with only 8 of the 66 cities reporting shortages.

** Tabulation of construction wage rates for 26 individual trades in 66 U. S. cities is available on request.*

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ENGINEERING NEWS-RECORD

SEPTEMBER 30, 1948 VOL. 141 NO. 14

Spend all available funds highway officials urged

Future federal-aid dependent on spending present money, speakers tell ASSHO—Maintenance panel highlights sessions at Salt Lake City

By L. L. Wise

Full use of available funds and the necessity of keeping existing highways on an efficient basis by maintenance and reconstruction formed the theme of the 34th annual meeting of the American Association of State Highway Officials held Sept. 19-24 at Salt Lake City, Utah.

Relative to spending available funds, association president R. H. Baldock, Oregon state highway engineer, explained how the Federal Aid Highway Act of 1948 barely passed Congress because many states had not yet spent the money made available to them in 1944. This failure to spend funds, Mr. Baldock pointed out, is placing the entire system of federal-aid for highway construction in jeopardy.

Figures point out failure

Statistics on this subject were presented by Thos. H. MacDonald, Commissioner of Public Roads, who said that only about 60 percent of the 1944 allocations were placed under contract in the three years allowed for that purpose. In terms of construction put in place, only about 40 percent of the funds were used in that period.

In another address, Senator Arthur V. Watkins (R., Utah), a member of the sub-committee on roads, told the meeting that Congress extended the time available to spend the 1944 funds by two years because of the failure of the states to use the money. In the 1948 act, he said, Congress appropriated only $450,000,000 a year for two years instead of $500,000,000 a year for three years as in 1944.

Mr. Baldock termed the failure of some states to spend available funds the most important problem before highway officials today.

Maintenance discussed

Second important topic of discussion both in major speeches and an afternoon-long panel discussion was the need for maintenance and reconstruction. In his presidential address, Mr. Baldock stressed this need as "not so much the opening up of new highways as the reconstruction of old, obsolete, worn-out highways."

Maj. Gen. Philip B. Fleming, Federal Works Administrator, in speaking on highway safety, also urged the reconstruction of obsolete roads and building not only for today's needs but for future needs.

State highway departments in 1947 spent $446,000,000 on maintenance and employed 109,000 men for the work. According to Commissioner MacDonald, 66 percent of revenues available to the state highway departments are used on maintenance. To perform this work, the departments have 40 percent fewer men than in 1936 and 40 percent more miles of highway for the various State highway departments to maintain.

J. A. Anderson, commissioner, Virginia Department of Highways, outlined the system used in his state whereby all maintenance funds are allotted to only one department of the state government and all work performed by it. Thus, with minor exception, there are no county maintenance forces. In this way one administrative and engineering staff covers the whole area. Total equipment investment is 20 percent less than under the conventional county and state system.

For more efficient maintenance, C. H. Sells, retiring superintendent, New York Department of Public Works, suggested accurate and complete cost accounting records. With such records available, the relative economy of force account versus contract on major maintenance items can be determined. Equipment rental can be carefully checked

(*Continued on p.* 41)

Electrical workers may quit AFL

The International Brotherhood of Electrical Workers is going to fight hard for what it considers its jurisdictional rights. This was made clear last week by the 2,500 convention delegates at Atlantic City, N. J.

In support of a "tough" attitude toward jurisdictional issues, particularly in the construction industry, the convention granted President Dan W. Tracy authorization, which he requested, to withdraw from the National Joint Board for settling jurisdictional disputes "if such action becomes advisable" to protect the interests of IBEW.

Since the plan, in effect since May 1, binds all unions affiliated with the AFL Building and Construction Trades Department, the IBEW would have to withdraw from that organization. The convention authorized that step also. The IBEW was out of the AFL building trades department in the early 1930's, and can disaffiliate again without leaving the AFL.

Tracy has been opposed to the plan since its inception, largely because it enforces existing jurisdictional decisions disliked by the IBEW. Of the 19 building trades unions, the IBEW and the elevator constructors were the only ones that voted against the plan for settling jurisdictional disputes.

The IBEW convention action raises a club over the heads of those making jurisdictional decisions involving this union of 450,000 members. It stands as a threat to the success of the plan, since it can only work if its decisions are accepted in good faith.

The convention asked for repeal of the Taft-Hartley labor law, which was criticized in many respects, but chiefly because of its use against the IBEW to stop secondary boycotts.

In one situation, involving Oak Ridge, NLRB this month obtained an injunction against the IBEW to end a secondary boycott and strike against Roane-Anderson Co., which operates utilities at the atomic reservation. The injunction, issued by Federal District Judge George C. Taylor at Knoxville, Tenn., will remain in effect until NLRB decides secondary boycott charges filed against IBEW Local 760 by Roane-Anderson. About 70 of the 100 electricians have returned to work.

NEWS BRIEFS

Highways—Arterial highways in the vicinity of *Geneva, N. Y.*, will benefit by $3,000,000 worth of reconstruction recently approved by city officials . . . The location has been chosen for a highway bridge to cross the Maumee River at *Toledo, Ohio.* The $5,200,000 structure will span 3,920 ft. between Sumner and Oregon streets . . . Gov. William P. Lane, Jr., of Maryland, speaking at a recent *Silver Spring, Md.*, underpass dedication, announced that the Chesapeake Bay bridge "is about here", and a $200,000,000 state highway program is contemplated . . . "Superpikes" to connect the *Twin Cities* with both *Chicago* and *Duluth* have been suggested in a plan by Minnesota State Senator A. R. Johanson.

Public construction — Foundation work began recently on a 300-bed addition to the Connecticut State Hospital at *Middletown* to cost $1,700,000 and take a year to complete . . . Dredged material from the Delaware River Channel near *Wilmington* will be used as fill in reclaiming 700-acres of land for riverside industrial space in a project under supervision of Col. F. F. Frech, Philadelphia District Engineer . . . Construction will begin next summer on a $12,000,000 veterans' hospital in *Syracuse, N. Y.* . . . Bids were opened Oct. 21 on construction work involved in the $18,000,000 veterans' hospital at *Houston, Tex.* . . . The University of Missouri at *Columbia* will build two additional men's dormitory units at a cost of $4,000,000 . . . Plans have been prepared for construction of a 3,500-car underground parking area near the North Side business area of *Chicago*, which would cost $6,500,000 . . . Foundation test borings have been started for a $2,250,000 expansion of O'Connor Hospital in *San Jose, Calif.* . . . Bids will be asked in the next three months on the following Veterans' Administration hospitals: A $4,000,000 structure at *Tupelo, Miss.*, to house 200 beds; a 500-bed *Birmingham, Ala.*, building to cost about $9,000,000; a $3,500,000 hospital at *Tallahassee, Fla.*, for 100 beds . . . The cornerstone of a new $2,500,000 City Hall and Memorial Auditorium was recently laid at *Lynn, Mass.* . . . Clearwater dam on the Black River near *Piedmont, Mo.*, is virtually completed but for lining of its spillway. The $10,000,000 project was begun in 1941 and suspended during the war years . . . The Corps of Engineers expects to spend $10,500,000 in the Trinity River watershed near *Dallas, Tex.*, in reservoir work before next summer.

Industrial construction—The American Chrome and Magnesium Industry, Inc., has announced plans to build a $3,000,000 plant at *Anacortes, Wash.* . . . A $2,650,000 airplane parts production plant will be erected near *Cleveland, Ohio*, by the Borg-Warner Corp. . . . Construction has started on a 70-mile, 20-in. gas pipeline linking *Opelika* and *Reinhart, Tex.*, which will cost the Lone Star Gas Co. $3,500,000 and provide additional supply to *Dallas* and its environs.

Sewerage—Bids were opened recently at *Orlando, Fla.*, for work on nine portions of a job including gravity and pressure sewer lines and four pumping stations . . . *Bedford, Ind.*, has received approval of the Indiana State Stream Pollution Board for a $1,000,000 sewerage expansion, and preliminary surveys have been started . . . General obligation bonds for $800,000 will finance trunk sewers of the Lake City Sewer District north of *Seattle, Wash.* . . . *Syracuse, N. Y.*, will double the capacity of its Ley Creek disposal plant at a cost of $2,500,000 . . . *Philadelphia* has let contracts totaling $2,095,000 for one main relief and two intercepting sewers.

Labor—A three-week roofer's strike in *San Francisco* and *San Mateo* counties, Calif., ended recently when AFL union members accepted a 16-cent hourly wage raise and were promised another 9-cent increase for Jan. 15, 1949.

American engineer killed in Palestine ambush

John Locke Lewis, 55, who was employed as consultant for the Knappen, Tippetts, Abbett Engineering Co. of New York, was killed in an Arab attack on a UN convoy traveling from Tel Aviv to Jerusalem on Sept. 22.

Lewis joined the New York firm in May and left this country for Palestine on Aug. 15 to study a railroad project started by the Israeli government. His work near completion, he was to leave there for home within a few days. Three other members of the convoy were killed, and three were wounded.

Born in Phillipsburg, Pa., Mr. Lewis was graduated from Pennsylvania State College, and his home was in Philadelphia. He was a member of the Society of American Military Engineers.

New York state gets bids of $25 million Oct. 13

On Oct. 13 the New York State Department of Public Works will receive bids on 24 highway construction projects at an estimated cost of $25,476,500 —the largest single letting since the war. The jobs are in 23 different counties. Among the projects are:

Paving ten miles of the Catskill Thruway; the initial urban arterial route construction in Syracuse and Rochester; and nine railroad grade crossing eliminations, the largest of which is at Rockville Centre, Long Island—a project estimated to cost $5,067,000.

BULL SHOALS DAM on the White River in Marion County, Ark., was ready for first concrete last week. Aggregate plant, conveyor systems, cement silos and mixing plant were erected and the concrete placing trestle was well along. Estimated cost of the structure has recently been raised from $69,000,000 to $76,300,000.

AASHO members discuss problems

(*Continued from p. 39*)

against the owning of road equipment.

Bond financing on a free-road basis was recommended by Roy E. Jorgensen, deputy commissioner and chief engineer of the Connecticut Highway Department, as a better way to provide needed highways at an early date than through the construction of toll roads.

Mr. Jorgensen does not consider the prospects bright for any considerable increase in federal aid; and as current revenues are not sufficient for both maintenance and an adequate program of new construction, he believes that the states must look elsewhere for capital funds if their improvement programs are not to bog down hopelessly.

"Willingness to pay established tolls indicates that motorists want good roads and are willing to pay the cost of a plan that will give them the roads *now*", he said. Hence, he favors bond financing for a specific network of expressways because such highways "can be operated without the heavy overhead involved in toll highways and their service value is higher because there is not the toll deterrent to usage."

Mr. Jorgensen proposes to carry the bonds by "an additional increment of road-user revenue, definitely earmarked for that purpose." As the credit of the state will be back of such bonds, he said that interest rates should be lower than on toll-road bonds without that support.

More tax revenue needed

The need for additional tax revenues in most states was stressed at one session. Legislative interim committee studies have been conducted in several states.

In Californa increases in the gas tax from 3 to 4½ cents per gallon and in automobile registration fees from $3 to $6 a year will result in estimated new revenue for the fiscal year 1948-49 (the first full year under the new system) of $39,656,000 and $12,245,000, respectively. A new tax scale for trucks will add another $8,454,000 to the state's revenues.

Highway department organization

The Committee on Administrative Practices considered the problems involved in state highway department organization. E. L. Schmidt, Pennsylvania State Highway engineer, told how his state is handling a volume of construction larger than any other state. This was made possible he said by transferring almost all of the field engineers on survey and plan work to construction work. Design work is now being let to private engineers with the contracts for such work negotiated.

Attendance good

For the first time in AASHO history, roll call was answered by representatives of each of the 52 member groups (i.e. 48 states, District of Columbia, Puerto Rico, Hawaii, and the Public Roads Administration). Registration for the six day meeting totaled close to 1,000.

Resolutions

To help overcome the unsatisfactory progress made by many states in utilizing postwar highway funds, the association passed a resolution recommending that each state take positive action to ascertain the factors that are retarding progress and apply all possible corrective measures; to establish an adequate salary scale; to adopt a sound personnel policy affording opportunity for advancement and retirement benefits; and to maintain contact with colleges to encourage students to select highway engineering as a profession.

The association also reaffirmed its resolution of a year ago in recommending that each state undertake the development of a long-range plan. It declared the belief that highway financing should be borne not only by highway users but also by benefited property owners and the general public in proportion to the benefits received. It set San Antonio, Tex., as next year's meeting place.

Wesley W. Polk

New officers

The newly elected president of the association is W. W. Polk, Illinois chief highway engineer, and the first vice-president is C. M. Brown, Missouri chief engineer. Regional vice-presidents are Spencer Miller, Jr., of New Jersey, V. M. Baise of North Carolina, C. M. Ziegler of Michigan and A. F. Winkler of Montana.

Jury considers price racket charges

A federal grand jury specially convened for the purpose is investigating an alleged price-boosting racket in the building materials field in the Middle Atlantic states. Fifty witnesses, all persons connected with the building materials industry, have been subpoenaed to appear before the jury sitting in the United States Courthouse Building at Philadelphia, Pa. The probe is being conducted by the Middle-Atlantic field office of the Department of Justice. It is expected that many more witnesses will be brought to testify.

A Justice Department spokesman said that the probe is to determine the real reason for the high cost of homes in the Philadelphia metropolitan area. He said that department investigators were told that only firms on the preferred list can get building materials. Investigators have also found that certain firms dealing in building materials have joined forces in violation of the anti-trust laws, to keep prices high and to restrict the market by refusing to sell to any except favored customers who agree to bonus and kick-back charges.

Under this system, the Justice Department spokesman said, some builders were able to get materials without difficulty, and to finish their jobs on schedule, while others were compelled to wait months for deliveries. Many cases were reported in which cellars were dug for new homes and then all work suspended for six months or more because construction materials could not be obtained.

During the investigation collusion was uncovered among buyers as well as sellers of materials. The favored buyers, it was alleged, formed a combine of their own, buying up whatever materials were available and parceling them out among themselves.

The federal grand jury is also hearing from 50 to 100 witnesses who have asked permission to testify on difficulties encountered in buying materials.

Federal Judge James P. McGranery announced that he considered the investigation of such importance that a full Federal Grand Jury of 23 members has been impaneled to conduct it.

Municipal utilities need insurance to cover accident and damage claims

New England Water Works Association hears how liability insurance should be applied by municipal utilities to provide protection against public claims.

Public claims for injuries or damages are becoming an increasingly serious problem for municipal agencies, Charles C. Goodrich, insurance adviser, Hartford, Conn., told 570 engineers and waterworks managers of the New England Water Works Association which met in New York City on Sept. 14-17.

Public claims, said Mr. Goodrich, arise from three general sources: impure products, hazardous structures and properties, and construction projects. The "products claim" for impurities or contamination in water supply should be feared by water companies because of possible huge damages. Good engineering practices and numerous test-sample records are the chief guards against such claims, he said.

Claims arising out of risks of ownership of street valve-boxes, water and sewer pipes, dams and reservoirs and service buildings can be controlled by proper maintenance and regular inspections.

Construction work done either by the water utility or a private contractor is probably the most frequent cause of public claims, Mr. Goodrich declared. In the latter case, he cautioned, court decisions generally hold that a water utility cannot escape liability for injuries to the public by hiring an independent contractor to perform an inherently hazardous undertaking.

Mr. Goodrich pointed out that municipal utilities should protect their own interests with a two-part insurance program: a cost-plus policy to meet smaller claims and a high-limit contract to guard against catastrophic claims. Cost-plus programs, which recognize special conditions—such as a better accident record than that of neighboring utilities, have shown consistent savings for the large majority of users, he said.

Insurance protection against catastrophic claims—such as collapse of a dam, major sewer explosion or large water-impurity claim—should have a limit of at least $100,000 for one claimant and $1,000,000 in the aggregate, Mr. Goodrich suggested. This coverage should be purchased separately from the cost-plus programs and on a flat-rate basis; and its limits should be high enough to cover all insurable risks.

When construction work is performed by an independent firm, the contract should call for placement of liability insurance with limits commensurate with the nature of the work and degree of exposure. Mr. Goodrich recommended that this insurance provide both personal-injury and property-damage coverage and be placed with a company acceptable to the principal.

Award and new officers

William Storrie, consulting engineer, Toronto, Ont., was awarded the Dexter Brackett Memorial Medal for his paper, "Toronto Water-Works Extensions—A General Description of the System with Details of Some Outstanding Features."

New officers are: Arthur C. King, president; Sidney S. Anthony and Gordon M. Fair, vice-presidents; William P. Melley, treasurer; and Joseph C. Knox, secretary.

Report goes to Congress on Arizona water project

Colorado River water, over which seven western states have been battling for 25 years, became a national political issue last week.

The Truman administration, represented in this case by Interior Secretary Krug, tossed the water fight into the campaign on Sept. 16. Krug did it by sending to Congress a report recommending construction of the Reclamation Bureau's Central Arizona project.

The $738,000,000 project would take an estimated 1,200,000 acre-ft. of water per year out of the Colorado, spreading it over parched farms in Arizona. California, claiming that Arizona is not entitled to more Colorado River water, will fight the proposal to the last ditch. Nevada will help her. Other basin states —New Mexico, Colorado, Utah and Wyoming—are lined up behind Arizona.

The fight over the Central Arizona project has been building up since last February, when Krug sent Reclamation's studies on the job to the basin states for comment (*ENR*, June 3 Vol. p. 921). This was a routine step, preliminary to forwarding the report to the President and Congress.

Interior Department pointed out that the law requires a delay of only 90 days for the states involved to comment. California asked for more time, and Krug held off for some 200 days. His aides said the report was "expedited" at this time so that Congress can look it over before January.

More dams planned

Interior and its Reclamation Bureau want to build more dams on the Colorado—only major western stream for which the government has been unable to schedule full development.

The bureau thought it had a suitable compromise after studying the Central Arizona project for several years. For an estimated total of $738,408,000 it proposed to build the Bridge Canyon Dam and power plant above Lake Mead and to divert irrigation water from the Colorado several hundred miles downstream.

The power plant would produce revenues sufficient to pay off much of the construction costs, the bureau estimated. Further, most of the proposed 770,100 kw. of hydroelectric capacity probably would be available to California.

Though Reclamation's report says that sufficient water now is available for central Arizona, Krug emphasized that he would not attempt to "decide or prejudice" the opposing claims of Arizona and California.

Paving contract let on Taconic extension

A contract for completion of a 21-mile extension of the Taconic State Parkway near Poughkeepsie, N. Y. was let recently on a low bid of $4,610,525 by John Arbosio, Inc., of that city. Grading for this section was completed to subgrade level some time ago at a cost of about $2,800,000.

Taconic State Parkway, with its southern connecting parkways, now provides a continuous route free of commercial traffic from New York to U. S. 44 northeast of Poughkeepsie, where northbound traffic now has to backtrack to the congested Albany Post Road at Poughkeepsie. Its extension northward to an east-west highway near Lafayetteville will provide badly needed traffic relief and easy access to highways from that point north, to Albany.

The present contract, which averages $220,000 a mile, covers a 6-in. base course under an 8-in. concrete pavement 24 ft. wide on each roadway, concrete reflecting curbs, 8 ft. shoulders, top soil and seeding on rock-debris fills, landscaping, and drop inlet gratings.

The work is being done under the direction of James S. Bixby, district engineer, New York State Department of Public Works.

AGC ponders price and wage problems

Impact on the construction industry of two recent Supreme Court decisions —those affecting the basing point price system and the avertime wage rate structure—were the prime concern of members of the Associated General Contractors of America at the mid-year board meeting in Chicago, this month.

It was reported that 91 percent of the members replying to a recent inquiry reported increases in steel and cement prices, and it was felt that other construction materials might also be taken off a uniform delivered price basis with consequent similar results. Contractors feared that unless the Wage and Hour Act decision in the west-coast longshoremen's case was clarified with respect to the construction trades, the industry might have to curtail operations to a strict 40-hr. work week to avoid paying extra overtime wages on top or normal overtime.

At the concluding session, the board unanimously nominated Adolf Teichert, Jr., Sacramento, and Walter L. Couse, Detroit, as president and vice-president, respectively, for 1949.

Cement case

Addressing 300 association directors and national and chapter officers, William Simon, general counsel for the Senate Committee on Trade Policies (Capehart Committee) which is inquiring into the Cement Case decision's effect on the national economy, asserted that the pricing policy which will best serve the free-enterprise, competitive system will be determined by the committee, and mentioned some of the arguments placed before that body.

To date, the majority of complaints to the committee have been from small building material dealers, cement block manufacturers, and steel fabricators whose suppliers are more distant than those of their competitors. Proponents of the basing point system have pointed out the added burden of figuring traffic routing and transportation costs that will now have to be undertaken by the buyer, Mr. Simon said, as mill quotations alone without freight charges are meaningless to a contractor preparing a bid. Other charges received by the committee are that the decision would tend to concentrate users near suppliers, which would be contrary to the government's policy of industrial plant dispersion, or that it would force construction of new mills in other localities not now served.

It was announced that Walter L. Couse, an AGC member, had been invited to Washington to join the advisory council to the Caphart Committee to present the contractor's viewpoint on the court decision. Mr. Couse stated that the price increases attributed to the ruling have as yet caused little curtailment of construction, but that the impact will be felt next year when higher costs may force the abandonment or adjustment in scope of projects now being planned.

Overtime question

In commenting on overtime pay, James D. Marshall, assistant managing director of the association, pointed out the possible consequences of the recent court decision that has confused the construction industry on the question of what is true overtime and what is premium pay. He warned the meeting that unless a contractor can prove that overtime payments are just that—rather than extra pay for inconvenient hours or for working on undesirable days—he may have to pay additional overtime on the premium pay. Mr. Marshall recommended that to prove that Saturday, Sunday or holiday pay or pay for work after a certain hour was really overtime wages, men who have not worked the specified minimum hours should not be worked during the time when non-statutory overtime is paid. To be in the best position to accomplish this, the contractor's work-week and pay-week should start Monday morning.

President Dwight W. Winkelman of the AGC announced a recommendation that building trades apprentices should be allowed to complete their training before being drafted under the new selective service act. The recommendation would allow construction apprentices to complete their training if they had been under the program at least six months, would remain in training while deferred and would complete the apprenticeship while still young enough to be eligible for the draft.

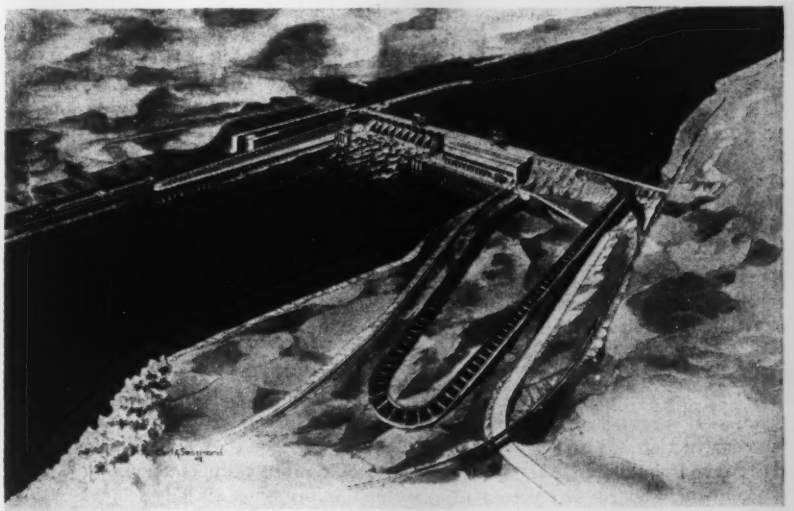
Mr. Winkelman pointed out that more than 130,000 apprentices are now in training, and that many of them will receive military education in the 100 construction reserve units that the association is sponsoring for the Corps of Engineers' Army Affiliation Program. It is expected that the 100-unit goal will be reached within the next 30 to 45 days.

Jurisdictional disputes

A report of the functioning of the National Joint Board for Settlement of Jurisdictional Disputes indicated an almost complete absence of serious stoppages of work by jurisdictional disputes since the board has been established (*ENR*, Aug. 26, p. 1).

It was suggested that where jurisdiction is in question, a joint fact finding board be established to determine the local custom in the area in which the dispute arises. This would be used as a guide to decide which union should perform the work while awaiting final

(*Continued on p.* 44)



Corps of Engineers Photo

ICE HARBOR DAM, first of four authorized by Congress for the lower Snake River in Washington, is in the preliminary survey stage. As pictured in this Corps of Engineers drawing, the $87,000,000 structure would form a 35-mile reservoir and include navigation locks, fish ladders and a 425,000-kw. power plant. To include the Lower Monumental, Little Goose, and Lower Granite dams, the series of projects will cost $$330,000,000 and pools formed will provide slack-water navigation from McNary Dam to Lewiston Idaho.

Electrical workers hear jurisdictional decision

A jurisdictional dispute over the preheating and stress-relieving of welds on a power plant construction job in San Antonio, Tex., was decided recently by the joint board for settlement of jurisdictional disputes in the construction industry.

This is the third decision—all by unanimous vote of the two union and two contractor members and impartial Chairman John T. Dunlop—under the joint AFL-contractor machinery, which went into effect last May, (*ENR* Aug 26, p. 1). And it is the first one directly involving the International Brotherhood of Electrical Workers, whose convention recently authorized President Dan W. Tracy to withdraw from the plan if this was necessary to "protect the interests" of the IBEW. (*See p.* 39).

The joint board decided in the latest case that:

1. Installation of induction pre-heating and stress-relieving equipment, including the wrapping of coils, is the work of the IBEW.
2. Installation of manufactured resistance coils is the work of the plumbers—United Association of Journeymen and Apprentices of the Plumbing and Pipe Fitting Industry.
3. Operation of pre-heating and stress-relieving equipment and instruments for pipe welding also is the work of the plumbers.

This issue was brought before the joint board by a contractor, Gibbs & Hill, Inc., of New York, covering a dispute between the two unions on a power plant being built at San Antonio for the City Public Service Board.

On this job, the IBEW was operating the equipment covered in point 3 and the plumbers were wrapping the coils, covered in point 1. The decision exchanges the work between the unions.

The IBEW expressed dissatisfaction over point 3 because it claims it is operating this equipment, now given to the plumbers, on 75 percent of the construction jobs, and all will be affected.

To avoid stoppages

Acting on complaints that jurisdictional work stoppages have occurred in the construction industry in violation of the May 1 industry-labor agreement, the nine-man board of trustees of the National Joint Board has recently adopted a three-point guide as a means of curbing such stoppages.

The board has elaborated on Article VII of the agreement, which states that (1) members of AFL building trades unions will remain at work while a jurisdictional dispute is being processed through the joint board machinery and (2) they shall continue to work on the basis of their original assignments, provided that no contractor will assign work contrary to decisions or agreements of record.

AGC mid-year meeting

(*Continued from page* 43)

board action. That the present board agreement be extended beyond its Dec. 31 expiration date was also recommended.

Concern was expressed over the increase in specialty contractors and the amount of work done by them in some areas. It was felt that this situation was the result of union inclination to furnish workmen—especially of the trades in which the labor supply is tight—to these operators rather than to the general contractor because the unions claim that they have better labor agreements with the specialized groups.

On the subject of housing construction, the meeting was told that a more accelerated allowable depreciation of costs would be a potent spur to increased volume and lower prices. A better policy of writing off construction costs for tax purposes would be more effective than federal subsidies, it was said, and this could be tackled on local and state levels rather than through Congress.

Federal works

A committee report to the AGC board members stated that recent modifications in the Bureau of Reclamation's concrete specifications involving finishes and forms have already saved considerable money for contractors and the bureau. On Corps of Engineer jobs, it was felt that where the work was delayed by the government or their other contractors or by lack of delivery of material to be furnished by the government, a mere extension of time was not always sufficient compensation for damages. A recommended change in the present government standard contract form would permit additional claims now outlawed by a recent Supreme Court decision.

Some members commented that present bidding procedures are sometimes unfair in that they expose the contractor's figures to his competitors on a rebidding, when all bids are rejected as being too far over the owner's estimate. Under one novel scheme advanced to remedy this situation, sealed bids would be received, the owner's estimate would then be opened and read, after which any bidder who desired could withdraw his tender before any of the other bids were opened.

Budget forces big lay-off by Reclamation Bureau

Between 2,000 and 2,500 employees of the Bureau of Reclamation will be dismissed or transferred as the bureau reshuffles its personnel to fit within limitations currently imposed by the present Congress.

Bureau officials estimated that every reclamation region will be affected by the personnel shifts.

Spokesmen for the bureau said the transfers and dismissals were necessitated by limitations written into the Interior Department Appropriations Bill for fiscal 1949. The principal proviso involved, they said, was the ceiling of $48,000,000 set by Congress for the bureau's annual payroll.

A committee of bureau officials recently reviewed the programs of the various reclamation offices and set up salary quotas for each office so that the bureau would remain within the $48,000,000 ceiling. One effect of this allocation job was the termination of a large proportion of the bureau's force account work, though a number of regular staff jobs also were eliminated.

MAJOR MEETINGS

American Institute of Steel Construction, annual convention, Chateau Frontenac, Quebec, Can., Oct. 4-7.

Concrete Reinforcing Steel Institute, semi-annual meeting, Grove Park Inn, Asheville, N. C., Oct. 5-9.

American Society of Photogrammetry, semi-annual meeting, Benjamin Franklin Hotel, Philadelphia, Pa., Oct. 7-8.

Seabee Veterans of America, First national convention, La Salle Hotel, Chicago, Ill., Oct. 8-10.

American Society of Planning Officials, national planning conference, New Yorker Hotel, New York City, Oct. 11-13.

Institute of Traffic Engineers, annual meeting, Hotel Warwick, Philadelphia, Pa., Oct. 11-13.

American Society of Civil Engineers, fall meeting, Statler Hotel, Boston, Mass., Oct. 13-15.

American Public Works Association, public works congress and equipment show, Copley Plaza Hotel, Boston, Oct. 17-20.

Federation of Sewage Works Associations, with annual meeting **Michigan Sewage Works Association,** Hotel Statler, Detroit, Mich., Oct. 18-21.

National Safety Congress, Stevens Hotel, Chicago, Ill., Oct. 18-22.

Joint Meeting Four States and Western Pa. sections of A.W.W.A., Penn Sheraton Hotel, Philadelphia, Pa., Oct. 20.

Structural Engineers' Assn. of California, annual convention, Biltmore Hotel, Santa Barbara, Calif., Oct. 21-24.

American Welding Society, annual meeting, Bellevue-Stratford Hotel, Philadelphia, Pa. Week of Oct. 24.

OBITUARY

W. G. Stromquist, 63, formerly a sanitary engineer with the Tennessee Valley Authority, died Sept. 11. He had retired early this year after 15 years in the Health and Safety Division where he had specialized in malaria control work. Previously he had served as sanitary engineer for Birmingham, Ala., and Memphis, Tenn. During the first world war he worked with the U. S. Public Health Service at Muscle Shoals. He was a civil engineering graduate of the University of Illinois, 1910.

W. T. Ryan, 64, consulting engineer for the Steubenville, Ohio, works of the Wheeling Steel Corp. since 1923, died Sept. 10. Formerly he was chief engineer of the American Sheet & Tin Plate Co. at Vandergrift, Pa., and of the Mark Mfg Co. at Indiana Harbor, Ill.

Walter H. Barnum, 56, Texas State Highway Department engineer for Rockwall County for about 12 years, died at Dallas, on Sept. 12.

Oscar Shanks, 72, retired construction engineer for Swift & Co., Chicago, died in that city Sept. 20. A graduate of the University of Chicago, he joined the U. S. Engineering Department at Louisville, Ky., in 1887. During World War I he was engineer in charge of construction work for Swift & Co. in South America.

George W. Francis, 65, retired civil engineer, died on Sept. 16 at his home at Greenwood, Del. Formerly he was associated with the Delaware State Highway Department, and from 1940 to 1946 he was employed by the federal government as a civil engineer.

Raymond L. Bell, 49, civil engineer, died at New Philadelphia, Ohio, Sept. 20. He had been a member of the engineering firm of Arnold, Rosch & Hartline for 15 years.

R. M. Taylor, 79, retired Jackson, Miss., city commissioner, died Sept. 10. He had been commissioner of public works, including the waterworks, public buildings, parks and playgrounds.

William B. Wroth, 58, irrigation engineer, employed the last two years with the U. S. Bureau of Reclamation at Sacramento, Calif., died Sept. 13 in that city. He was a graduate of Cornell University, and all his subsequent life he was engaged in engineering work in the west and southwest. He formerly worked with the War Relocation Authority and the Soil Conservation Service in Colorado and New Mexico. He was a veteran of the first World War, having served in the Navy.

Capt. Samuel Earnest Lambert, 39, who was a reservoir engineer for the Shell Oil Co. in Houston, Texas was killed September 12 in the crash of a training plane near New Orleans, La.

William T. Dorrance, Jr., 41, of Glastobury, Conn., assistant superintendent of bridges and maintenance for the Connecticut State Highway Department, died Sept. 20 from injuries received on Sept. 2, while inspecting the mechanism of a bridge draw in Milford. He was graduated from Brooklyn Polytechnic Institute as a civil engineer.

James S. Branigan, Sr., 58, assistant engineer in the topographical department of New York City, died at West New Brighton, N. Y., Sept. 22.

Harvey Paul Jones, 57, senior partner of Jones & Henry, Toledo, Ohio, sanitary engineers, died Sept. 24. He designed and constructed Toledo's sewage treatment plant, intercepting sewer system, and the connecting sewer tunnel under the Maumee River. He was graduated from the college of engineering at the University of Michigan in 1916. He went to Toledo that year to help Fuller and McClintock, New York consultants, in a study of a modern sewer system for the city. He continued as resident engineer later when the New York firm was commissioned to design and construct the city's first intercepting system and treatment plant, an $8,000,000 project. Mr. Jones formed H. P. Jones & Co., in 1926. The company became Jones & Henry in 1944 when the founder went into partnership with Thomas B. Henry. Mr. Jones' last piece of work for Toledo was completed just two weeks before his death, when plans for a $7,000,000 improvement to the Bay View Park sewage treatment plant were submitted.

James B. Cochran, 52, former resident engineer for the sewage commission of Louisville, Ky., died at Rochester, Minn., Sept. 16. Since 1942 he had been a district engineer for the Louisville & Nashville R. R.

Harold W. Smith, 61, who was superintendent for the Mt. Vernon Bridge Co. and built the Main St. bridge in Jacksonville, Fla., died at Hamilton, Ohio, Sept. 15.

CONSTRUCTION ACTIVITY

CONTRACT VOLUME

Continental U. S. Only (Thousands of Dollars)

	Week of Sept. 30 1948	Cumulative 1948 (40 wks.)	Cumulative 1947 (40 wks.)
Federal	$20,589	$757,412	$505,122
State & Mun.	48,020	1,999,374	1,317,538
Total Public.	$68,609	$2,756,786	$1,822,660
Total Private	59,530	2,516,011	2,450,554
U. S. Total..	$128,139	$5,272,797	$4,273,214

WHERE CONSTRUCTION ACTIVITY ORIGINATED THIS WEEK

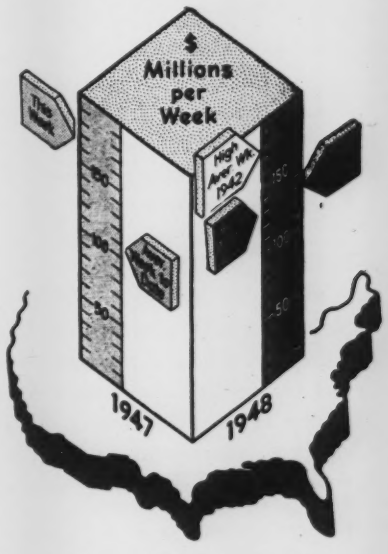
Dollar Volume (Thousands)

Type of Work	This Week	Cumulative 1948 (40 wks.)	Cumulative 1947 (40 wks.)
Waterworks ...	$683	$161,400	$83,002
Sewerage	2,557	169,156	105,421
Bridges	11,505	224,077	136,633
Highways	23,061	800,545	619,976
Earthwork, Waterways	16,453	402,530	238,262
Buildings, Public	15,102	826,098	440,999
Industrial ...	26,908	738,120	683,966
Commercial ..	24,078	1,444,060	1,426,754
Unclassified ...	7,792	506,811	538,201

NOTE: Minimum size projects included are: Waterworks and waterway projects, $28,000; other public works, $50,000; industrial buildings, $68,000; other buildings, $250,000.

NEW PRODUCTIVE CAPITAL

	Cumulative 1948 (40 wks.)	Cumulative 1947 (40 wks.)
NON-FEDERAL	$3,592,674	$1,798,717
Corporate Securities	1,758,898	632,759
State and Municipal	1,341,587	918,247
U. N. Bldg. Loan..	65,000	.....
Fed. Aid Highway.	427,289	247,711
FEDERAL	1,558,932	818,729
Total Capital	$5,251,606	$2,617,446



As Reported this week to...
Engineering News-Record

ENR INDEX NUMBERS

Index Base = 100		1913	1926
Construction Cost..	Sept. '48	476.80	229.20
Building Cost	Sept. '48	356.70	192.82
Volume	Aug. '48	254	111

EDITORIALS

VOLUME 141 NUMBER 14

September 30, 1948

Reducing Construction Costs

A CHOICE OF TYPES of structure as well as methods of construction is offered to contractors who next month will submit bids on three and one-half miles of storm sewer at Detroit (see page 70). By this means, it is hoped to get more favorable bids than if a single type of sewer conduit had been specified because each bidder can select the type of structure with which he is most familiar or which he can build most easily with available equipment or materials. Thus each contractor should be able to estimate his costs quite closely and, at the same time, each should be able to cut the contingency item in his bid, because there will be fewer unknowns in his estimating. While this idea is not new, its possibilities have not been fully explored. For public-work agencies, it would appear to offer a sound means for reducing construction costs.

Check Your Liability Insurance

MUNICIPAL ADMINISTRATORS received a pertinent reminder at the recent meeting of the New England Water Works Association (p. 42) that adequate liability-insurance coverage should not be overlooked, particularly in connection with construction projects. This counsel, by Charles C. Goodrich, an insurance adviser of Hartford, Conn., comes at a time when many municipalities have increased their force-account operations in an effort to cope with the high cost of contract work. Not only does this mean an increase in volume of construction with consequent increase of hazard possibilities, but there is also the probability that force-account gangs are not so fully indoctrinated with safety precautions as are those under contractor supervision. Therefore, placement of sufficient liability insurance to cover all risks fully should not be neglected.

Deep Concrete Pours

WORTHY OF SPECIAL NOTE by dam builders is the practice of the construction division of the Hydro-Electric Power Commission of Ontario in making single pours in its large dams as deep as 50 ft. in one continuous operation. This development was reported in an article on Stewartville Dam in the Sept. 2 issue of *ENR*, p. 64. From a study of pressure on the forms for blocks of concrete in gravity dams having a large area, the commission's engineers learned that no stronger forms are needed for high lifts than are required for much lower lifts. The reason for this, they concluded, is that the concrete in the lower part of the high forms sets at such a rate as to relieve all hydrostatic pressure before the forces from the semi-fluid mass get too great. The economies that high lifts make possible are considerable, and the number of construction joints is very materially reduced. Combining high lifts with the use of low-heat cement seems to offer new possibilities for speeding dam construction.

For Faster Construction

MCNARY DAM on the Columbia River, costliest of current construction projects, can also be one of the most efficient if its latent possibilities are fully developed. Planned to supply power for the growing Northwest, it involves $200 million of concrete dam, high-lift lock structure, powerhouse, earth dikes, electrical equipment, railroad relocation and other numerous items. Such diversity and complexity suggests a number of separate contracts so that neither the contractors nor the government will be tied up with too many eggs in one basket nor for too long a time. The Corps of Engineers has already recognized this by planning to let the major contracts in steps. What remains to be done is for the government to make the necessary money available so that the work can go ahead at the most effective and efficient pace. Too often in the past, Congress has been willing to start huge construction projects, only to slow them later by insufficient or delayed appropriations. A great and expensive project such as McNary should not be made more costly by such an uncertain policy. And it need not be if advantage is taken of the possibilities that it offers for continuous high-speed construction.

Brooklyn Bridge

NEWS THAT NEW YORK CITY has signed a design contract for the modernization of Brooklyn Bridge marks the end, it may be hoped, of the procrastination that has plagued this inevitable project for almost two decades. Now 65 years old, the famous structure has been little more than a majestic monument in recent years, as traffic requirements have outdistanced its ability to meet them. Yet its massive stone towers and its 15½-in. cables are known

to have strength and to spare for supporting a major traffic artery. Only its deck and its stiffening trusses need replacement and rearrangement. That this can be done for about $5,000,000 is the present estimate, but if another million or two should be necessary, the investment would be worthwhile. Probably $30,000,000 would have to be spent for an entirely new structure that would be no better physically and probably inferior esthetically.

To be able to retain what is widely regarded as one of the most beautiful structures that man has created and at the same time make it as modern as any entirely new facility is rare enough. To be able to preserve almost intact a monument to American engineering genius that is a full half-century older than such other notable examples as the Empire State Building, Hoover Dam or the Golden Gate Bridge makes the opportunity unique.

That the task has been entrusted to D. B. Steinman is also worthy of comment. Not only does he have the necessary technical talent, but his deeply ingrained and developed sense of the beauty inherent in suspension structures should assure that the appearance of the bridge will be treated with respect. The fact that he was born and has lived all his life in the neighborhood of the bridge, whose creators, John and Washington Roebling, have inspired both his works and his writings, makes this doubly certain.

No more postponements should be permitted to delay longer this important and necessary project.

Building Code Drafting Troubles

BACKED BY A CENTRAL AGENCY for certifying conforming materials, a model national building code of the performance-standards type can reduce construction costs. That, in brief, was the idea of the Building Officials Conference of America when, about 2½ years ago, it initiated preparation of such a code and set up the Building Officials Foundation as the central clearing house for test data and their interpretation. But the BOCA is not finding the going easy, and it may be that the building officials have not selected the proper methods to implement their plans.

With respect to preparation of the model code, for example, the BOCA has proceeded on the assumption that building officials are best qualified for the task. They are doing the job themselves, overlooking the fact that materials manufacturers, architects, engineers and contractors, collectively a large segment of the building industry, may also have important contributions to make.

When the first draft of the code was completed, it was submitted to manufacturers and also to some organizations of engineers and architects. The former group objected to many provisions, but it has no guarantee that its recommendations will be accepted. For example, it has not yet seen the code for small cities, an abridgement of the model code, approved two weeks ago by the BOCA without advising interested parties as to the disposition of objections. The architect and engineer bodies ignored the BOCA request for comment. Thus, the code has been prepared almost exclusively from the enforcement viewpoint. The officials obviously want a code that is easy to enforce, and since specifications simplify enforcement, they naturally are enticed back to a specification-type, voluminous document.

With respect to the Building Officials Foundation, the agency set up to test and certify materials, the BOCA has proceeded on the assumption that industry stands to gain most from its work and therefore should finance it. Manufacturers have supported it in a small way, but there is an undercurrent of resentment. Industry feels its contributions are in the nature of gifts to the BOCA, and doesn't like the idea. On the other hand, architects, engineers and contractors fear that manufacturers may exercise undue influence on the BOF to get materials approved.

It is not beyond the range of possibility that the necessary support and cooperation of all these groups may be obtained by a change of procedure on the part of the BOCA. For example, a full-scale attempt to give architects, engineers, contractors and the technical specialists of materials manufacturers a voice in the final drafting of the model code may prove well worth while. It may also be wise to drop the grandiose schemes for a heavily financed BOF and put the organization on a self-sustaining basis, whereby fees for its services will pay its expenses. Some reorientation of plan and objective seems necessary to assure more rapid and certain progress toward the badly-needed national model code.

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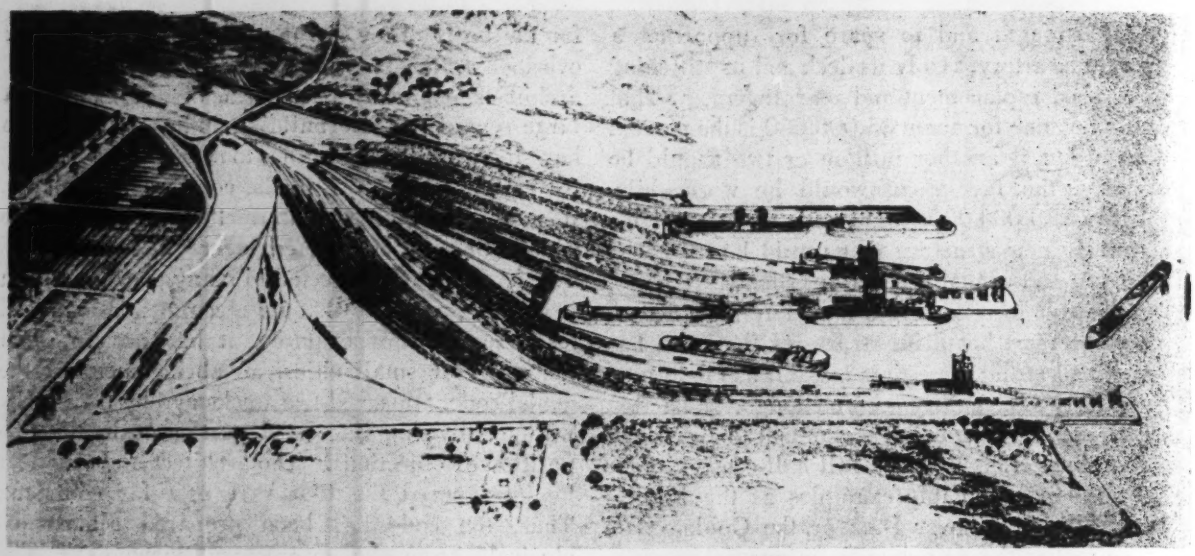

FIG. 1. THREE NEW PIERS have been built on the Lake Erie waterfront to speed ore and coal handling.

New Rail-Water Terminal at Toledo Improves Coal-Ore Transfer

Put into service this year on the lakefront at Toledo was a rail-water terminal designed to facilitate movements of coal and ore through that port over the New York Central and the Baltimore & Ohio railroads. It consists of a wide maneuvering basin for ships, three piers equipped with large capacity car dumping and ore unloading machines, backed by ample railroad yard for the storage and marshalling of railroad cars. Land and construction costs were about $18,500,000.

The new terminal was built jointly by the two railroads through the agency of the Lakefront Dock & Railroad Terminal Co., which also will operate the terminal facilities. It replaces old terminals located 5 and 7 miles from the mouth of the Maumee River in congested areas where expansion was not practical and where access from the lake was restricted by several drawbridges. Ships lost from two to three hours making the round trip.

The new joint facilities occupy a 212 acre site outside of all these restrictions with a long frontage on Maumee Bay, as shown in Fig. 1. The inner end of the receiving and departure yard connects with the tracks of the Toledo Terminal Railroad Co.

Total trackage within the new terminal is 56 miles. There are 26 tracks in the receiving and departure yards, 20 of which have a capacity of 150 cars each. The three operating yards in back of the piers can accommodate more than 1,700 cars, while an adjoining storage yard on the east can take care of 460, with land available for an increase of storage yard capacity to nearly 1,100 cars.

Each load yard serving a car dumper has a capacity of more than 250 40-ft. cars. With 70-ton cars in the yard, this capacity is sufficient to fill the largest lake vessel, which carries 18,000 tons of coal. Since a car dumper can handle one car every minute, a lake vessel of maximum capacity can be loaded in six hours, including a time allowance of one hour and fifteen minutes for warping the ship into position.

The layout of the piers was determined largely by the shape of the property, final location of some structures being based on information as to underground conditions obtained by test borings. Dredging requirements were determined after a number of conferences with the Lake Carriers Association.

Test borings revealed dense glacial till about 80 ft. thick overlying limestone bedrock. The top of the clay was from 8 to 20 ft. below the existing bottom of the bay (El. 550 to 560) and 20 to 30 ft. below pier grade, at average El. 581.

Dredging was carried down to 25 ft. below mean low water datum. A total of about 2,500,000 cu. yd. was removed to get a minimum 25-ft. depth for slips ranging from 1,100 ft. to 2,100 ft. long and a ship maneuring area of more than 37 acres. This area has a width of 500 ft. and an average length of 2,200 ft. adjoining the 500-ft. wide government navigation channel. Cutting to 25-ft. depth, the 12-yd. dipper dredge Mogul loaded about 12,000 cu. yd. of clay in 24 hours into scows for dumping 12 miles out in Lake Erie.

Bulkhead walls totaling 8,400 lin. ft. in length encompass the three piers. The slip on the west side of the west pier is reserved for storage of waiting vessels and for winter mooring. Bulkheadwalls of the remaining two slips afford mooring berths for nine lake boats 500 to 650 ft. long, four under the machines and

five waiting. In the winter, mooring space is available for about double the number that can be served during the operating season.

Pier walls consist of Z-section steel sheetpiles 55 ft. long, driven to a penetration of 19-ft. below dredged grade, with welded double-channel wales bolted to the backs of the walls and timber bumpers bolted to the outer face (Figs. 3 and 4). The Z-piles weigh 38 lb. per sq. ft. of wall and 57 lb. per lin. ft. of pile. They have a depth of 12 in. and an effective width of 18 in. between interlocks. Along straight runs of bulkhead, the wall is tied back by 2¾-in. tierods on 6-ft. centers; at rounded corners of the piers, the tierods are increased to 3½-in. dia.

Bulkhead anchorage

In the outer portion of a pier, where the width is less than 267 ft., the tierods run continuously across the pier between the wales of the opposite walls. Toward the inshore ends, where the width of pier increases, the rods are tied back to concrete anchor walls on timber piles. The concrete tieback are believed to be superior to the timber bulkhead on anchor piles originally proposed but discarded in favor of the improved design.

Tierods are upset for turnbuckle connections. Where tierods are installed above original ground level, they are supported at 30- to 40-ft. centers on wooden joists that are carried by timber piles 18 ft. apart. Tierods below ground are supported on wooden blocks in trenches backfilled with sand to produce greater frictional resistance than clay fill.

Inside the sheetpile bulkhead walls, the terminal constructors built up the piers to grade by placing fill of fine clay, much of it passing a 200 mesh sieve. The fill compressed the mud bottom of the bay against the underlying clay. Because of the nature of the material entrapped behind the bulkhead walls, reinforced Z-section sheet piles are used outside the areas where pressure is relieved by timber pile foundations under the car dumpers, ore unloaders or other structures. The reinforcement for each sheet consists of two 7 x ¾-in. x 22-ft. cover plates riveted to the outer surfaces of the two legs. Riveting was used instead of welding to avoid distortion of the piles. Size of the plates was designed to keep fiber stresses under 18,000 psi.

FIG. 2. COAL CARS can be handled by this dumper at a rate of one 70-ton car each minute, making it possible to load a lake vessel in a little over four hours.

Foundation piling

Car dumpers and ore unloaders are heavyweight machines. Structural framing and machinery of the first car dumper erected at the terminal—a new unit—weighed 1,600 tons. Two old dumpers transferred from the former New York Central terminal grossed 1,200 tons each.

Weight of each of the two ore unloaders, including the traveling bridge and operating machinery, is 800 tons. Two of these units, moved from the Baltimore and Ohio ore dock on the Maumee River, operate along 700 ft. of track on the west pier.

About 10,000 wood piles, ranging from 40 to 50 ft. long, designed for 18-ton loading were used to support these structures. For the three car dumpers and their three substations, the foundations called for a total of 2,121 piles—105,000 lin. ft. of untreated and 15,000 lin. ft. of treated. Most of the woodpiling was cut off one foot above mean low water level; the lake level normally stands 2 to 3 ft. above that level, and the pile heads are incased in concrete foundations that extend some distance below pile cutoff grade.

Piledriving operations

Five diesel-powered crawler cranes handled the setting and driving of steel sheetpiles and timber piles. Of these rigs, three worked on Z-section sheetpiles, putting down an average of 35 in 8 hr. and a maximum of 50.

Z-section piles 55 ft. long, weighing 3,700 lb. per pile when reinforced with two 22-ft. cover plates, were

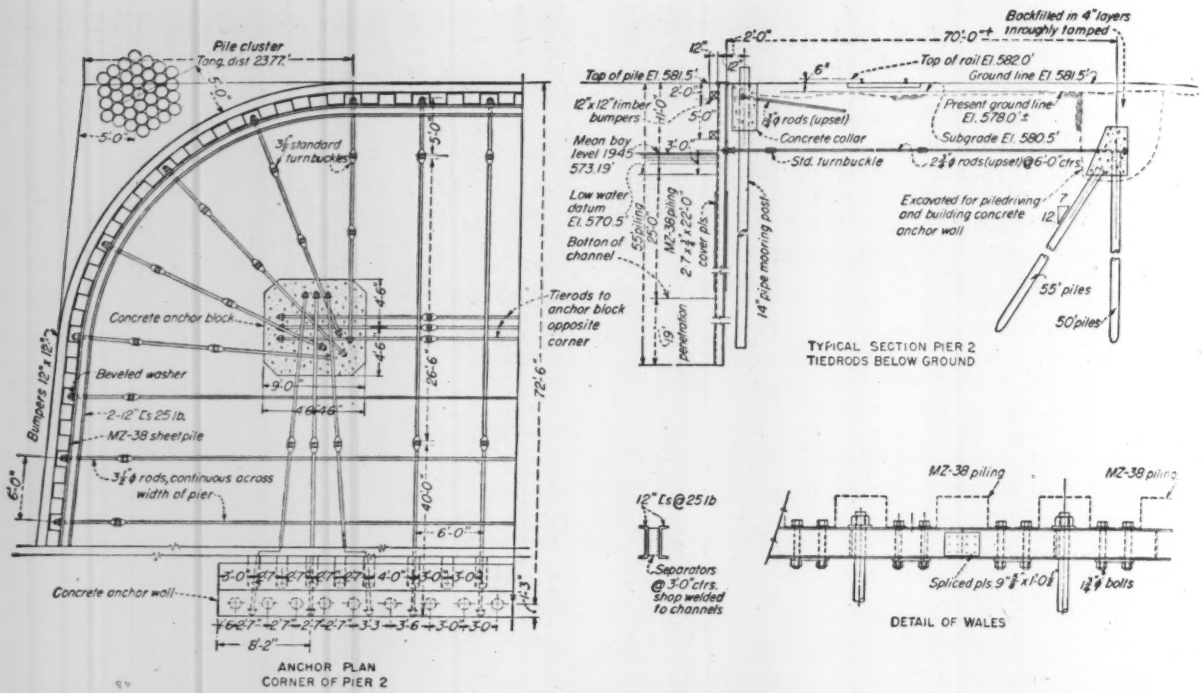

FIG. 3. THIS TYPE OF BULKHEAD was used to retain the fill for most of the pier work. Tierods were continuous across the pier until the width exceeded 267 ft. For greater widths, concrete anchor walls were buried in the fill.

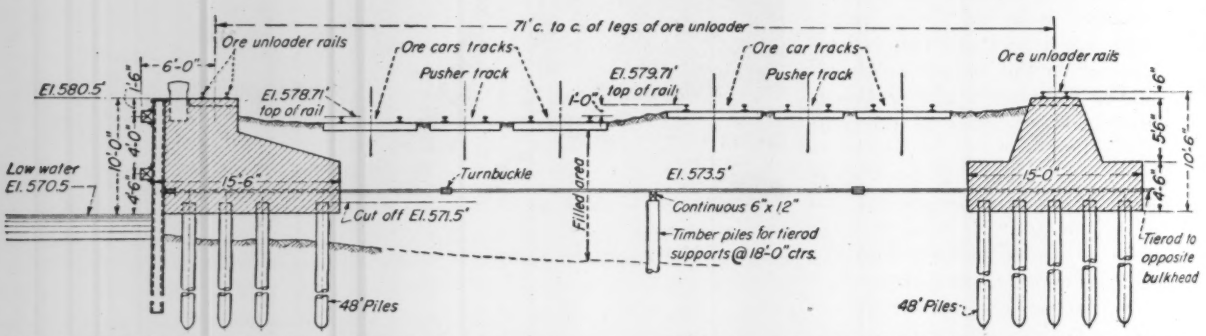

FIG. 4. UNDER THE CAR UNLOADERS the pier design was modified for a length of 700 ft. to provide support for those heavy gantry type structures with a span of 71 ft.

threaded by a crane with a boom 110 ft. long; this rig also moved and set the timber-frame templates which guided the setting of the sheetpiles. For driving the sheets in early stages where resistance was not too great, a second crane with a 65-ft. boom used an 11,000-lb. single-acting hammer equipped with a 1,500-lb. anvil block that fitted the top of two Z-piles. The hammer delivered 60 blows per minute of 16,250 ft.-lb., ordinarily using air from three portable compressors with a capacity of about 1,500 cfm. at 100 psi.

Hard driving of the sheetpiles to full penetration was completed by a monkey-on-a-stick rig hung from the 50-ft. boom of a third crane. The hammer, traveling on a vertical guide beam suspended from a second hoist line, was a steam-powered double-acting unit capable of striking about 90 blows per minute of 18,000 ft.-lb. with its 5,000 lb. ram. A 100-hp. boiler furnished steam to this hammer.

Creep in the sheetpiles

Z-section sheetpiles set and driven in the bulkhead walls produced about one foot of creep, or excess length, in 48 ft. Variations in effective width of sheetpiles occur in the interlocks and may cause either creepage or shrinkage. As one explanation, the variation may be caused on the last pass through the rolls in the steel mills, forming the female prong. Sheetpiles on the terminal job gave as much as ⅜-in. excess width per pile.

In starting the job, both the steel suppliers and the contractors recommended driving piles with the ball ahead to avoid filling the female end with dirt. On this project, the sheetpiles were driven both ways with no noticeable difference, probably because of the character of the soil encountered.

Tops of all sheetpiles were cut off to grade by burning, about 12 in. usually being removed. Holes for wale bolts were burned in the sheet-

FIG. 5. WHEN DRIVING OF Z-PILES became hard, full penetration was accomplished by use of a double-acting hammer on a suspended guide beam. The hammer had a harness of slotted side plates and an anvil block to spot it on top of two piles.

pile wall by a workman on a raft using a tee-square template hung on the piles to spot the holes.

Timber piles were driven without difficulty. Two rigs put down these piles at an average rate of 45 per rig in 8 hours. Each of the two cranes carried swinging leads on a 110-ft. boom and drove the piles with a single-acting hammer, either steam or air-powered. Hammers delivering 7,500 to 15,000 ft.-lb. per blow were used.

Earthfill from borrow pits

To build up the grade of the piers and railroad yards required about 1,750,000 cu. yd. of fill. Any attempt to use dredged material for this purpose would have required hydraulic dredging and pumping to a settling basin, entailing great loss of time. Consequently, all fill material was taken from a half dozen borrow pits at an average one-way haul distance of 1½ miles and a maximum of 2 miles. Using ten shovels and draglines of ¾ to 2-yd. capacity to load about 70 trucks, plus about eight rubber-tired tractor-scraper units loaded with the aid of pusher and puller tractors, earthmoving subcontractors were able to average about 14,000 cu. yd. of compacted fill in 10 hours.

For the railroad yards, grade was built up to El. 579.5, largely in former marsh. Where marsh muck exceeded 1 to 2 ft. in depth, it was removed and replaced with dry material on good clay bottom. The fill was carried up by end-dumping from trucks and spreading in 1-ft. loose layers for compaction by equipment. The superimposed load of fill compressed the shallow marsh muck without serious displacement. Oil sludge from adjacent refineries had deposited at some places in the marsh, and these sludge deposits were removed by clamshell before dry material was dumped.

Oil and gas lines, water lines and power lines of 15 companies had to be relocated by the terminal company in connection with the construction. At the south end of the railroad yards, it was necessary to relocate 27,000 lin. ft. of oil lines belonging to nine oil companies before filling operations could begin.

One of the largest of the changes involved the building of a complete 6 x 10-ft. culvert about 700 ft. long to carry the effluent channel from an oil refinery across the property. Otter Creek road was rebuilt on new location for about 4,200 ft. adjacent to the east side of the receiving and departure yards. From this highway, a new access road involving a bridge over the railroad tracks and another bridge over Otter Creek was constructed to serve the west pier.

About 30,000 cu. yd. of concrete was required for foundations, bridges, culverts and other structures. Foundations for the car dumpers required four continuous pours of more than 600 cu. yd. each. Concrete was batched into transit truck mixers at a central plant of the general contractors. At the delivery points, crawler cranes handled the concrete into the forms in buckets.

Handling cars

The main railroad yards of the terminal are operated with steam power, and the load yards supporting the dumpers and ore machines are serviced by electric pushers. Electrically operated retarders control the return of empty cars from the dumpers to the empty yard.

Chief officers of the Lakefront Dock and Railroad Terminal Co. are R. E. Dougherty, of the New York Central, president, and A. C. Clarke, of the Baltimore & Ohio, vice president. W. N. Young is chief engineer in direct charge of the project, Ken L. DeBlois is design engineer; B. G. Etchison, construction engineer; and C. F. Meyers, operating superintendent.

Safety School Cuts Steel Erection Accidents

Mervyn G. Gaskin
President, Taylor & Gaskin Inc.
Detroit, Mich.

A safety school where the pupils are 1,400 hard-bitten steel erection workers and the teachers are insurance company experts and engineers, has resulted in the drastic reduction of accidents in steel erection in the Detroit area.

So effective, in fact, has the school been that the basic rate for workmen's compensation insurance in Michigan has dropped from 28.95 in 1944 to 17.57 this year, and union figures show that accidents to their membership dropped off 20 percent the first year, with a corresponding decrease in benefit payments.

This drastic change in the accident picture in the Detroit area, with its attendant results of greater profit to contractors and steadier pay and physical health to the workers, was achieved through the enthusiastic collaboration of the Steel and Metal Erectors Association of Michigan, Local No. 25 of the International Association of Bridge, Structural and Ornamental Iron Workers of America, and engineers for the Employers Mutual of Wausau, an insurance firm.

Long recognized as one of the most hazardous trades, steel erection hazards have been reflected in the high cost of workmen's compensation insurance—approximately double that of manufacturing industries.

The problem of establishing safety rules and educating workers to them is complicated in this industry by the constantly changing groups of employees, the varying conditions on each construction job and weather.

From the standpoint of the employer, steel erection is a highly competitive business and into every bid for a job must go a percentage to take care of the cost of workmen's compensation insurance. Labor unions face the constant drain on their membership for payment of disability benefits, and the more serious loss of earnings by the members.

This situation, of course, tends to discourage new men from learning the trade, and older men have been found to be changing over to trades requiring similar skill but which are of less hazardous nature. Steel erectors are scarce, and, in order to encourage men to learn this trade it is necessary to make the work more attractive.

With this situation in view, the writer's company four years ago turned to the Employers Mutual, and put in that company's hands the problem of devising a safety program to keep compensation costs in line. A. J. Diedrich, the Employers Mutual local engineer in Detroit, worked with Otto S. Holmskog, our company's senior construction engineer, to set up a safety program that considerably reduced the accident rate in fabrication departments. However, this program left something to be desired for steel erection.

We then went to the crux of the trouble, and decided that the only permanent solution of steel erection accidents in the Detroit area was the education of the 1,400 steel and iron workers who made up the labor pool.

Quarterly meetings held on safety

A general meeting of the Steel and Metal Erectors Association and representatives of the local union was held in Detroit in June, 1945. At this meeting, Mr. Holmskog and Mr. Diedrich presented a review of their work in the steel erection field and made suggestions for a specific safety campaign that would gain the acceptance of management and employees.

It was decided to carry on this safety program through a new section—the Steel Erectors Division—of the Detroit Industrial Safety Council. The new section was directed to hold meetings at regular intervals between management executives, supervisors and union representatives.

Now held four times a year, these meetings bring together at dinner from 65 to 80 representatives of these groups. Discussions on various safety problems are led by representatives of the Detroit Industrial Safety Council, management, safety engineers and specialists in particular fields.

All those attending have the chance to ask questions and offer suggestions as to solving specific safety problems of the industry. Qualified speakers on such problems as "The Safe Use of Cranes," "Fire Prevention," "Electrical Hazards," appear.

Importance of such matters as the regular use of hard hats, safety belts, goggles and safety shoes with composition non-slip soles is continually emphasized. Supervisors are instructed on best methods of laying out a job for an easy flow of material and equipment, and how to store material in a safe manner. They are constantly reminded that no unsafe equipment should be accepted for use on a job, and of the importance of physical examinations in this type of work.

After each meeting, the foremen hold meetings at the job site the following day to advise the men under them of what they have learned, and are given specific thoughts to emphasize to the men—impressing on them the need to work safely and see that all conditions around them are safe, and to check all equipment, and to report any faulty equipment.

The best measure of the success of the program has been the figures, some of which were quoted at the beginning of this article.

The base rate for workmen's compensation insurance in Michigan dropped 11.38 from 1944 to 1948; and in the case of our own company, our experience credit has increased from 5.5 percent better than the base rate in 1944 to 26.1 percent better than even the lower base rate in 1948.

The industry-wide program has attracted the attention of steel erectors and union representatives in all parts of the country, and we have urged contractors and steel erectors in every large area to conduct similar meetings. We shall be glad to cooperate with them.

The success of the school has been made possible by the enthusiasm and cooperation of the members of our own association and the loyalty and interest in their work of our supervisory employees and the men in their charge. Cooperating in it have been the Detroit Industrial Safety Council; the officers of Local 25; Mr. Holmskog and Mr. Diedrich; and the safety engineers and equipment suppliers.

Irrigated farm layout related to soil and topographic conditions points to . . .

A New Concept In Land Improvement

C. J. Francis
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Soil Conservation Service, Lincoln, Nebr.

COMPLETE physical development of land for irrigation, and the layout of farm-unit boundaries based on soil and topographic conditions is a new approach to the establishment of efficient farming operations in arid areas.

The construction procedures, pioneered by the former Farm-Security Administration and recently carried on by the Soil Conservation Service of the U. S. Department of Agriculture, should hold more than academic interest for contractors who may find in this type of land development opportunities for their participation.

By way of background it should be pointed out that the old method of developing irrigation projects by subdividing the land into farm units—using the General Land Office rectangular survey system—is uneconomic and has rapidly become obsolete. This method does not give proper consideration to soil conditions and topography. And it leaves the development of the land and farm distribution system to the farmer—who usually lacks the right kind of equipment, technical knowledge and experience to do a complete development job according to the capabilities of the land.

Some 47,000 acres of land already have been improved for irrigation using the new methods. The first development was that for the Buffalo Rapids project in Montana, and this was followed by similar operations on the Buford-Trenton project in North Dakota and the Mirage Flats project in Nebraska.

Application of new principles

Illustrating the application of this new concept of development are the planning and construction procedures used at Buffalo Rapids.

The project area is contained in a narrow strip, some 50-mi. long, adjacent to the Yellowstone River and extending from Terry to Glendive, Montana. Water is obtained from four pumping plants which take their supply from the Yellowstone. The total irrigated area includes 25,907 acres, of which 16,472 acres are in government ownership and 8,435 acres are privately owned. The project was authorized under the Case-Wheeler Act, which was aimed at relieving distress created by the drought period of the 30's.

The development program is primarily adapted to areas where the land can be purchased in large blocks. This is easy of accomplishment in arid sections of the country. The purchase of a major part of the project area permits the reorganization of farm-unit boundaries on the basis of soils and topography, which is an important factor in any irrigation development.

Those lands that are in private ownership are supplied with water and the operators are given technical assistance in development. If requested, construction equipment is furnished. Land owners pay the full cost of any land development work. The technical assistance is furnished by the government at no cost.

First step at Buffalo Rapids was to make a complete topographic map of the area for planning the farm-unit boundaries and farm-distribution systems. The map was prepared on

a scale of 200 ft. to the inch with a contour interval of 0.5 ft. for land slopes of from 0 - 1 percent, 1 ft. for lands sloping 1 to 3 percent, and 2 to 5 ft. for lands over 3 percent slope. These maps were turned over to soils technicians who mapped on them soils classification information.

Surface and subsurface soil conditions were studied and the land divided into three classes of irrigable land and one of non-irrigable land.

When the topographic and land-classification surveys were completed, mosaic maps of the project or segments of the project were drafted showing soils information and topography. Agricultural specialists developed cropping enterprise plans adapted to the local soils, climatic, and marketing conditions. They determined the approximate size of farm suitable to employ a farm family, provide an adequate family living, pay the cost of annual farm operations (including annual irrigation construction operation and maintenance charges), and provide for overhead expenses.

Engineering influences layout

Engineers and agriculturists worked together in laying out farm units containing enough acreage of first and second-class irrigable land to provide the productive capacity needed for the family-size farm. Unit boundaries are influenced by the pattern of canals and drainage right-of-ways, as well as the acreage requirements. Efficient operation is considered also in planning the size, shape, and irrigation layout of fields. From the data contained on these maps, boundaries were tentatively established providing for an acreage of good irrigable land that would provide a reasonable net return under average management conditions.

The boundaries also are affected by the location of the surface drainage system which is designed to handle waste irrigation water and runoff from adjacent dry land. Such low grade irrigable land and non-irrigable land as exists in the area is attached to the various units in a manner that will provide for efficient use.

After the new unit boundaries had been established on paper, they were checked in the field to insure a soundness of location. As the unit boundaries do not follow the rectangular survey pattern, some existing farm-to-market roads had to be abandoned and new roads located to provide access to all the farms. The need for relocation of the road system was taken up with the responsible officials and arrangements made for abandonment of portions of existing roads and establishment of new ones.

After the unit subdivision was complete, the topographic and soils maps were studied to select areas requiring leveling. To prepare plans and conduct the land-leveling operations, detailed topographic surveys were made by taking the ground-surface elevations on a 100 ft. grid system. A profile along each grid line was plotted and grades established for the finished topography of the land in each unit.

The grade established for a given field was based on the original topography, the kind of soil and the method of irrigation recommended. For example, limiting grades for land planned for border irrigation were: Maximum slope in the direction of irrigation 2 percent; maximum cross-slope 0.2 percent. Grades were fixed to meet this requirement and adjusted to balance cut and fill to the extent that overhaul would be within reasonable limits. Soils information provided the basis for determining the feasible depth of cut where there was any question as to the fertility that would be obtained at the final grade elevation.

Concurrently with the establishment of the final grade of the field or farm unit, the distribution and drainage system was planned. The distribution system was designed to carry from 3 to 5 cfs. depending on the acreage of the unit. It provided for supplying water in the quantity and at the location required to properly irrigate the various fields making up the unit.

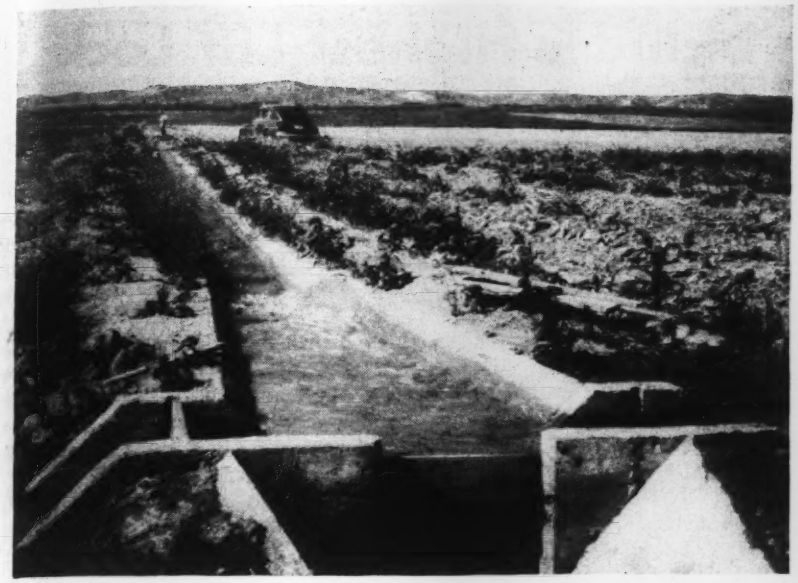
Ditches were frequently constructed on low fills to obtain a field subdivision that is adapted to the crops and rotations recommended. Consideration had to be given to the borrow required to make the ditch fills in establishing final ground surface elevations. As a general rule, cuts and fills averaged from 0.1 to 0.6 ft. on topography encountered on the Buffalo-Rapids project.

DROP STRUCTURES, designed for minimum formwork, stabilize grades in a head ditch on a steep slope.

The land leveled was in all stages of cultivation and much was in sod. Accordingly, there was considerable elevation variation in the original level readings of the ground surface at the grid points, particularly when the field had been cultivated. This factor, together with the low depth of cut and low height of fill, made it difficult to determine the shrinkage factor. Leveling operations were conducted with tractor and earth-movers of 10 to 14 cu. yd. capacity and these compacted the ground to a certain extent. Thus in some areas land surfaces where a fill of 0.1 ft. was indicated, a fill of 0.2 ft. might actually result because of the settlement occurring in the loose surface soil due to travel of equipment. Likewise, an area requiring 0.1 ft. cut might not yield any material due to compaction of ground surface.

Where leveling operations were light, a shrinkage factor of 80 percent was used with good results. Under normal conditions with heavier leveling the shrinkage factor ranged from 35 to 60 percent. The shrinkage factor was, of course, greater when operations were conducted at optimum soil moisture content and was greatest for such soils containing a high percent of sand.

When final grades were established and the distribution system planned, the cut or fill was recorded on a



CONCRETE-LINED CHUTE carries water down steep slope to prevent erosion. Turnouts in the chute divert water to the field distribution system.

stake at each grid point; then land leveling operations started.

It is customary to move earth parallel to one direction of the grid system leaving the stakes in place to guide the operator and permit making a final check. In work of this type a tolerance of 0.05 ft. above or below the grade is permitted. When the lanes have been brought to grade the narrow ridges of earth on the stake lines are cut out distributing the earth at a low point.

After the topography has been brought to design grades with heavy earth-moving equipment, the small variations in the land surface contour are smoothed by a land plane. Usually the area is covered twice with the plane, the direction of the operation being at 45 deg. each way from the leveling lanes.

When leveling operations are conducted and the soil moisture is near optimum, the compaction may be so great that the land cannot be plowed with ordinary farm equipment. When such a condition exists, the land is plowed with suitable equipment prior to planing.

The average cut for the 25,907 acres of land leveled on the Buffalo-Rapids project was 134 cu. yd. per acre. The total excavation was 3,500,000 cu. yd.

After the leveling and operation is completed and the ditch system serving the unit is staked, fills for elevated ditch sections having been previously made, the ditches are plowed with a ditching machine pulled by a small track-type tractor. Structures are built in the ditches to provide for the distribution of water to the various fields, to carry water across drainage-ways and to protect the ditch from erosion at those locations where the grade is too great. The plans for check, turnout, drop and siphon structures have been standardized to facilitate construction. Concrete is used generally although cresoted timber, corrugated metal, clay and concrete pipe structures function satisfactorily.

Prefabricated structures

Considerable work has been done in prefabricating concrete structures and in adapting commercially available pipe to many structural problems. All concrete structures are light-weight thin sections varying from 3 to 6 in. in thickness. Reinforcing consists of 3/8-in. rods placed 12 in. on centers. Where ditches are lined for long reaches to protect against seepage or to provide erosion control, a lining consisting of 4 in. of concrete without any reinforcing steel and no expansion joints has been placed. Dummy or construction joints to control cracking are spaced 8 to 10 ft. apart. This type of ditch lining has been in place for over five years and has successfully withstood the rigors of northern climates. Observation over a longer period will enable a determination to be made of the practicability of this type of low-cost lining.

Leveling of large tracts of land introduces wind-erosion hazards. So, to make the best use of the project area during the construction period those areas that are not planned for leveling during the crop season are leased to farmers for dry land farming. This provides for a vegatative cover that affords protection.

As construction proceeds, unit subdivision surveys are made establishing the permanent boundaries of the individual farms and roads, canals and drainage ditches that serve the farms. In general, the farm-unit boundaries and often the roads do not follow Government Land Office survey lines and a new subdivision of the area must be made. Closure surveys for each farm are made by metes and bounds survey and acreages computed by the double-meridian distance method.

The farm becomes a legal subdivision of land and is established as a farm unit, designated by number, when filed with the county recorder. An index or key map of the project area outlining the unit subdivision, the canals, drainage system, and highways are also placed on record. Highway relocations are worked out in cooperation with state, county and township officials.

Direction of work

Engineering work is under the direction of the chief of the engineering division, Region 5. General project planning and construction operations are supervised by D. S. McVicker, construction engineer; the project engineer is Merritt E. Hoffman. A. E. McClymonds is regional conservator for the Northern Great Plains region of the Soil Conservation Service.

The project works consisting of pumping plants, supply canals, and the main distribution systems required to carry water to the turnout for each farm unit were planned and constructed by the Bureau of Reclamation, which has this responsibility under Case-Wheeler legislation.

McNary Dam Includes Highest Lift Lock

With the letting of a $21,649,000 contract to McNary Dam Contractors, a joint venture, major work began Aug. 16 on the construction of McNary Dam; notable navigation and power project on the Columbia River between Washington and Oregon. To cost $227,000,000 (1947 prices), this project will provide the power-short Northwest with almost 1,000,000 kw. generating capacity and will overcome the most serious hazards now existing on the navigable part of the Columbia system. The concrete dam will be of the spillway type, similar to but larger than the Bonneville Dam on the same river. Its principal design feature is a 675x86-ft. lock having a single lift of 92 ft. under maximum conditions. A new system of filling and emptying to create a minimum of turbulence is being used.

With the exception of Hungry Horse Dam in Montana, McNary Dam is the only project now under way in this area that will provide a major source of new generating capacity. Before the war, with large unused capacity available from Grand Coulee and Bonneville Dams, a surplus of inexpensive power existed. However, new industries such as the aluminum plants near Portland and Spokane and the atomic energy plant near Hanford, Wash., have absorbed all available power. No large-scale industrial expansion will be possible until new generating capacity is provided. Installation of the first McNary Dam generator is not expected to be complete until 1954, or later depending on annual appropriations by Congress. Steam plants are considered uneconomical in the far Northwest as compared with hydroelectric power primarily because of the cost of importing fuel.

More major contracts later

Appropriation of $22,000,000 by Congress made possible the letting of the "step-one" contract under a construction schedule that calls for several different major contracts to be let as the work progresses. These contracts will fit the sequence required by maintenance of navigation and diversion of the river (average flow 185,000 sec.-ft.).

More than $7,000,000 of preliminary work has been completed, including excavation for the lock structure, construction of the Washington shore cofferdam, and starting the permanent and temporary operating and construction towns.

Other construction problems include grouting the foundations to seal an artesian stratum and almost 90 miles of railroad relocation including raising the elevation of three major bridges.

Power and navigation site

The dam is located some 2½ miles above Umatilla, Ore., near the foot of the Umatilla Rapids. Barge navigation of this portion of the river has been a factor in the economy of the region almost since the days of the Lewis and Clark explorations. However, the Umatilla Rapids presented a serious but not impossible navigation hazard. Thus, McNary Dam will overcome the most serious hazards now existing on the navigable part of the Columbia system by providing slack water for 60 miles up the Columbia and 10 miles up the Snake River.

This location takes advantage of the fall of the Umatilla Rapids for power development. The present 80,000 sec.-ft. of regulated low flow of the combined Columbia and Snake rivers can be harnessed at this point without flooding out too much valuable farm land. In fact, the irrigation of some 380,000 acres of land is made more economical by raising the elevation of the river and decreasing the pump lift. Drainage area above the dam is 213,500 sq. mi. and 109,000 sq. mi. of this is in the Snake River basin.

Studies have indicated that installation of fourteen generators, each of 70,000 kw. capacity, is the maximum desirable at this stage of the development of the river. Accordingly, provision is being made during the present program for the installation of fourteen units in increments as needed. However, future construction of regulating reservoirs upstream could economically raise the firm flow to as much as 111,600 sec.-ft. Hence, for further development, the embankment and powerhouse foundations joining the powerhouse to the Oregon abutment are to be built to render construction of an additional six units safe and economical.

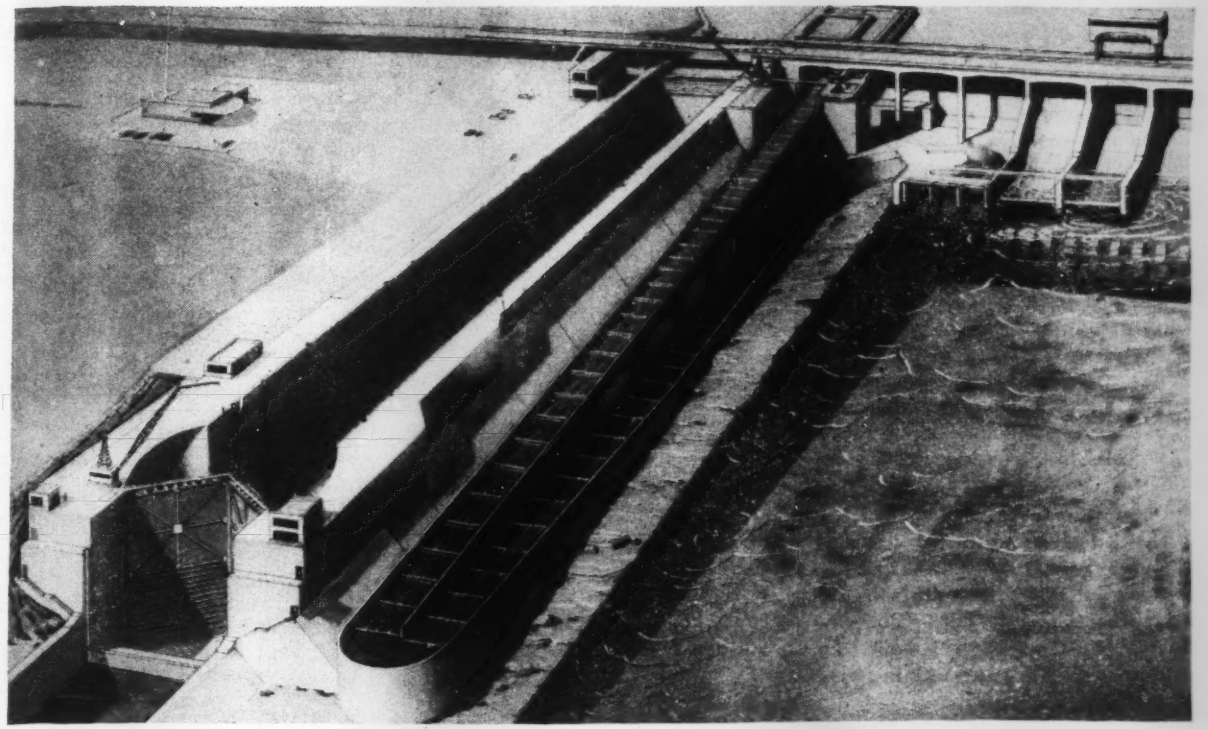
The resulting powerhouse to accommodate fourteen units will have an over-all length of 1,423 ft. Each of the 70,000-kw. generators will be driven by a 280-in. dia. Kaplan turbine. These turbines will be of the six-blade type and will have a capacity of 111,300 hp. each.

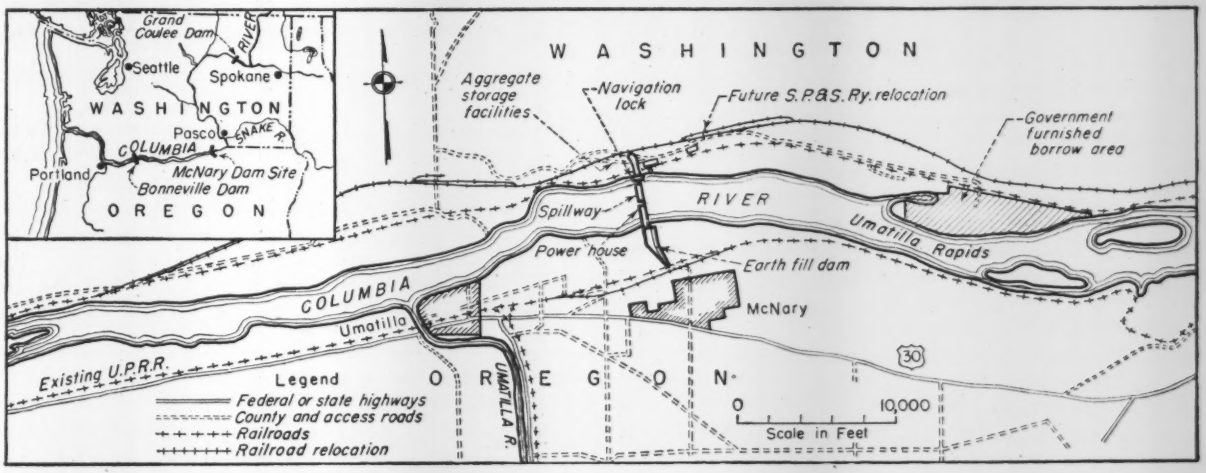
Besides the lock structure, the project will include a spillway dam 1,320 ft. long with 22 vertical-lift gates of 50-ft. span each. Crest elevation will be 291 ft. above sea level and, at a flow of 2,200,000 sec.-ft. (the design flood), the pool elevation will be 356.5 ft. Normal pool elevation is 340 ft. and the pool will remain at this elevation for all flows up to 1,500,000 sec.-ft. The maximum flood of record was 1,150,000 sec.-ft. and occurred in 1894. A flow of slightly more than a million second-feet was recorded in the 1948 flood.

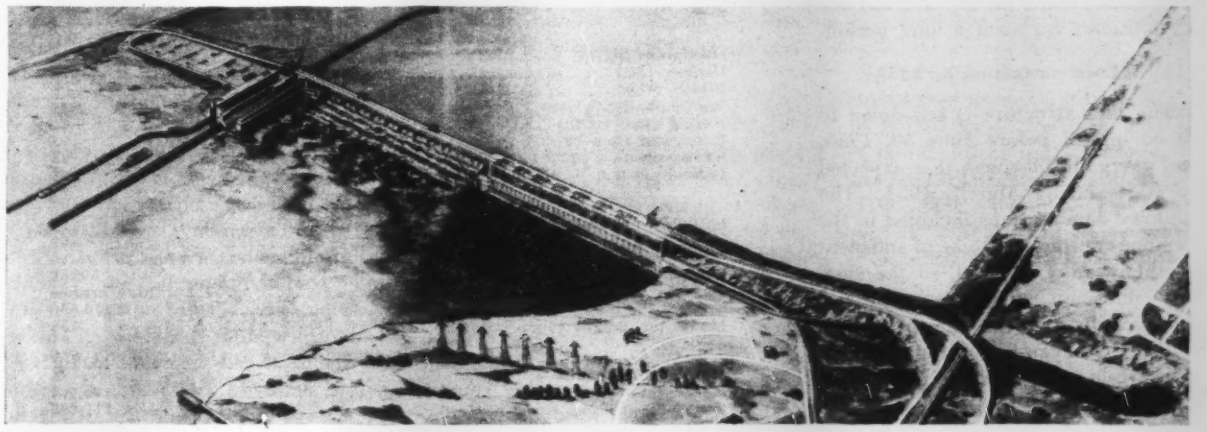
Two fish ladders and one fish lock are being provided to pass migratory fish upstream over McNary Dam. The fish lock is located between the spillway and the navigation lock. One ladder is located near each shore. These ladders are to be 30 ft. wide and will have a 1-ft. lift each 20 ft.

The total length of the dam is 8,725 ft., of which 3,082 ft. is concrete sections. The remainder is earth embankment. Major features are given in Table I.

WORLD'S BIGGEST—Maximum lift on the lock (top) will be 92-ft. Adjoining the 675 x 86-ft. lock will be a fish ladder and fish lock. The project is located (map) on the Columbia River, above Bonneville Dam, and the new structure will submerge Umatilla Rapids under its waters. The general view (bottom) shows an earth-and-rockfill dike at right, the powerhouse and the spillway dam structure at left.




Grand Coulee Dam
RIVER
Seattle
Spokane
WASHINGTON
Pasco
SNAKE R.
COLUMBIA
Portland
McNary Dam Site
Bonneville Dam
OREGON
WASHINGTON
Aggregate storage facilities
Navigation lock
Future S.P.&S. Ry. relocation
Government furnished borrow area
Spillway
RIVER
Umatilla Rapids
Power house
Earth fill dam
COLUMBIA
McNary
Umatilla
Existing U.P.R.R.
30
Legend
Federal or state highways
County and access roads
Railroads
Railroad relocation
OREGON
UMATILLA R.
0
10,000
Scale in Feet



Of the more than $7,000,000 spent on the McNary project up to July 1, 1948, $1,280,000 was for the first step cofferdam and $1,050,000 for the lock excavation. The remainder of the money went for engineering exploration, turbines and generators, railroad relocation, housing and maintenance.

All told, 24 contracts had been let for various work by the time bids were called for step-one construction. The major contracts (more than $200,000 each) are listed in Table II. The others vary in amount and nature and include such items as $4,000 for well drilling at the townsite of McNary, Ore., and some $70,000 for construction of aggregate storage facilities.

The "step-one" contract includes the entire lock structure and 13½ sections of the 22-section spillway structure. All work will be done inside a cofferdam previously constructed. Major quantities included are listed in Table III.

Several reasons prompted the letting of only part of the complete job at this time. For one thing, the construction sequence is dictated by required conditions and it is adaptable to letting a series of several contracts. Navigation must be maintained throughout the entire construction program. Hence, it was felt advisable to build the lock structure first, leaving the existing channel free during the lock construction. Besides this, the regular flow of the river must be handled and only part of the river can be obstructed at any one time.

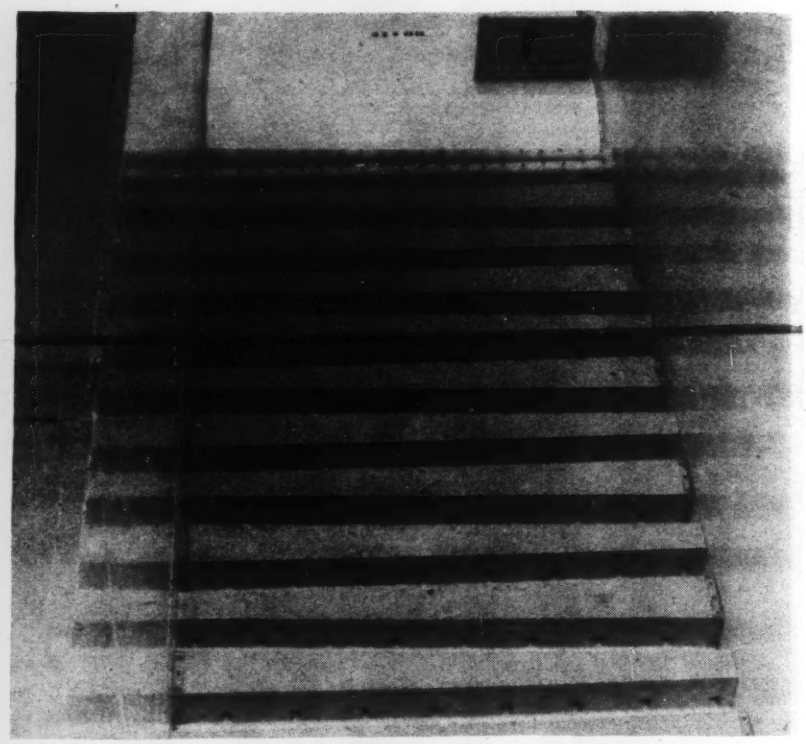
Furthermore, the present program contemplates a construction period of more than six years. Because of this it was believed that it would be better to commit neither the government nor a contractor for such a long period.

Lock navigation by 1951

The lock structure is scheduled to be completed before June 30, 1950, and navigation through it is expected to start during March, 1951. The spillway dam sections included in the step-one contract are to be of sufficient height by May 1, 1950, so the step-one cofferdam can be removed and the river diverted through them. This spillway dam can be built up to finish level while other work is going on.

Next contract will include construction of the Cofferdam on the Oregon shore and probably some work on a portion of the powerhouse. By May 1, 1951, the Oregon shore portion will be in the dry and work can proceed on the remainder of the spillway dam section, probably under a third contract. The spillway is expected to be completed by February, 1953, and the Oregon cofferdam can then be removed. The powerhouse substructure should also be done by 1953.

The program calls for installation of fourteen generators and work on four has already been scheduled. It is expected that even before the installation of these is completed, the increasing demand for power in the Northwest will require that the remaining ten be installed as soon as



A SYSTEM OF LATERAL CULVERTS and ports in the middle third of the lock will be used for filling and emptying, as shown by model used for testing.

Table I—McNary Dam—Project Features

General	
Cost (1947 prices)	$227,000,000
Total embankment (cu.yd.)	6,500,000
Concrete (cu.yd.)	1,500,000
Over-all length (ft.)	8,725
Mean annual river discharge (cfs.)	185,000
Lock	
Maximum lift (ft.)	92
Length (ft.)	675
Width (ft.)	86
Minimum depth over lower sill (ft.)	12
Filling time (min.)	14
Emptying time (min.)	15
Upstream gate height (ft.)	23
Downstream gate height (ft.)	106
Dam	
Spillway openings	22
Width (ft.)	50
Control	Fixed wheel lift gates
Size of gates (ft.)	50x52
Gates—method of operation	2 gantry cranes
Spillway capacity (cfs.)	2,200,000
Maximum height (foundation to deck) (ft.)	158
Power Plant	
Number of units	14
Generators (kw.)	70,000
Turbines—280-in. Kaplan (hp.)	111,300

possible. Space in the powerhouse for assembling and servicing the generators is limited so the installation program will necessarily be spread over a period of time. The fastest rate at which generators can be installed is one generator every 120 days.

Table II McNary Dam—*Major Contracts Let

Item	Contractor	Date Let	Amount	**Percent Complete
1. Navigation lock excavation	Guy F. Atkinson Co	4/14/47	743,485	100
2. Housing area utilities	Del R. Beebe Const Co	6/30/47	354,700	100
3. Dismantle, move, re-erect 36 apt. bldgs.	Waale-Camplan Co	10/14/47	511,608	100
4. Washington cofferdam	Guy F. Atkinson Co	10/30/47	1,116,610	100
5. Relocate 5.5 mi S.P.&S. Rwy	White Brothers Co	5/14/48	247,626	15
6. Reinf. steel (3,000 tons)	Tacoma Steel & Equip Co	6/10/48	293,670	15
7. Governing equip. for 4 hydraulic turbines	Allis-Chalmers Mfg Co	6/30/48	425,340	0
8. Four hydraulic turbines (111,300 hp)	S. Morgan Smith Co	6/20/48	5,031,567	0
9. Aggregate for step one construction	J. G. Shotwell	***	1,498,200	0
10. Step one construction	****	***	21,648,763	0

* More than $200,000
** As of 1 Aug. 1948
*** Low bidder. Contract not let as of Aug. 1, 1948
**** Joint venture of Guy F. Atkinson Co., Ostrander Const. Co., and J. A. Jones Const. Co.

Grouting to seal an artesian layer

The damsite is underlain by a 70- to 100-ft. layer of basalt rock. This is considered excellent foundation material. However, about 80 ft. farther down, there is an artesian stratum separated from the basalt by an interbed. An experiment conducted on the artesian layer indicates that it can be effectively sealed by grouting.

First step in this experiment was the construction of a shaft 8 ft. square, ending just above the artesian layer. Pipes extending downward were used to measure the flow. A tunnel was constructed around the bottom of the shaft on a radius of 15 ft. Eight holes were drilled from this tunnel and the artesian layer grouted. It was found that some 90 percent of the flow had been stopped. Grouting through eight more holes blanked off the remainder of the flow.

Based on the result of this experiment, a similar grouting program will be carried on under the entire dam.

Railroad bridges to be raised

Included in the facilities that will have to be relocated is 89.5 miles of main line railroad. These include routes of (1) the Union Pacific along the Oregon shore and crossing the reservoir; (2) the Spokane, Portland & Seattle Railway along the Washington shore of the reservoir; and (3) the Northern Pacific across the Columbia near Pasco, Wash.

Major problem involved in the relocation will be the raising of three steel truss bridges, each having a swing span. Largest of these is on the Union Pacific's Yakima branch. This bridge is more than 3,000 ft. long and it will have to be elevated a total of 11 ft. Other bridges are 2,600 ft. long, requiring a 5-ft. lift and 1,800 ft. long, involving a 3-ft. lift.

Portions of the railroads along the banks of the Columbia will have to be constructed on talus slopes underlain with silty material. This will involve cuts of as much as 400 ft. along the edge. Stabilization of these slopes may present difficulties.

First contract on the railroad relocation was let in May, 1948, for 5½ miles of the SP&S to White Bros. of Walla Walla for $274,626. Bids on this job are noteworthy because the Corps of Engineers received seventeen bids on this contract.

Besides these railroads, some 22.5 miles of county roads is to be relocated, as well as some 24.5 miles of state highway, 22 miles of power line and 22.5 miles of telephone and telegraph wires.

New town built

A complete new town is being built by the Corps of Engineers for construction and operation forces. Called McNary, Ore., it is divided in two portions, permanent and temporary. Included in the permanent portion is an administration building, a maintenance building, a bachelor dormitory, a theater and 108 family units. These latter vary from one bedroom duplex apartments to four bedroom single dwelling houses.

A complete system of utilities costing more than $1½ million is also being installed. This includes sewer and water systems, electrical distribution system, streets, roads, sidewalks and landscaping.

Features of high lift lock

Design feature of the McNary project is the navigation lock. Maximum lift of 92 ft. is made possible by a filling and emptying system to be used here for the first time. In this system fourteen lateral culverts extend across the middle-third of the bottom of the lock chamber. Water passes through eight ports on each side of each lateral.

Extensive tests were made at the Bonneville hydraulic laboratory on 1 to 25 scale models before this system was adopted. Basic research had previously been carried out by the corps at Iowa University. A similar smaller system is being installed at Lock and Dam 27 on the Mississippi.

Table III—Major Quantities, "Step-One" Contract

(Includes all classes for each item)

Excavation and embankment (cu. yd.)	2,845,000
Grout holes (lin. ft.)	21,000
Concrete (cu. yd.)	686,000
Structural steel (tons)	4,000
Reinforcing steel (tons)	8,250

In the design of methods of filling locks two criteria are considered; namely, time of filling and tension in the lines holding vessels in the lock induced by the turbulence of the entering water. This latter is known as hawser stress and is measured in tons. The object of design is to get the lock filled as swiftly as possible with a minimum amount of hawser stress—or with the hawser stress within acceptable limits. Obviously, water can be introduced at a rate that will introduce almost no turbulence and thus no hawser stress. However, at such a rate, many hours would be required to fill the McNary lock.

According to the model tests, maximum hawser stress on filling the lock will be 3.5 tons. The next best system tested—using longitudinal rather than lateral culverts—resulted in a pull of some 14.5 tons. The acceptable pull is between 3 and 5 tons.

The filling system includes culverts 11 ft. wide and 12 ft. high located in the wall on each side of the lock. Each culvert leads to seven lateral culverts that taper from a section 5 ft. square to 2 ft. square. On each side of the lateral culverts are eight rec-

WORK ALREADY DONE at McNary Dam when the "step one" contract was let included lock excavation (left) and construction of the Washington shore cofferdam.

tangular ports with rounded throats. Relatively even distribution of flow across the lock chambers provided by tapering the laterals and decreasing the size of the ports.

The lateral culverts are within the middle-third of the lock as it was found that less turbulence occurs when they are so located. They are on 19-ft. centers and the ports are placed so flow from them will not be directly opposed by flow through ports in adjacent laterals. Minimum initial "cushion water" is 18.8 ft. (cushion water is the depth of water over the mean elevation of the center line of the port openings).

Flow in the main culverts is controlled by reverse Tainter valves. The opening time of these valves is 4 min. and maximum turbulence does not occur in the lock until the full flow is entering. At this time there is somewhat more "cushion water" than 18.8 ft., thus lessening the effect of the turbulence.

The emptying system uses the same set of laterals and ports. Additional reverse Tainter gates located downstream in the main culverts control this flow. A set of six similar lateral culverts with larger ports is located below the miter gates for emptying.

A design problem of major importance is encountered in connection with the reverse Tainter valves. These are completely submerged and have a 7x7-ft. open shaft on the upstream side to allow water to cover the valve under normal pressure. This provides an extra volume of water for drawdown when the valves are first opened to lessen negative pressure on the gates.

Miter gate 105½ ft. high

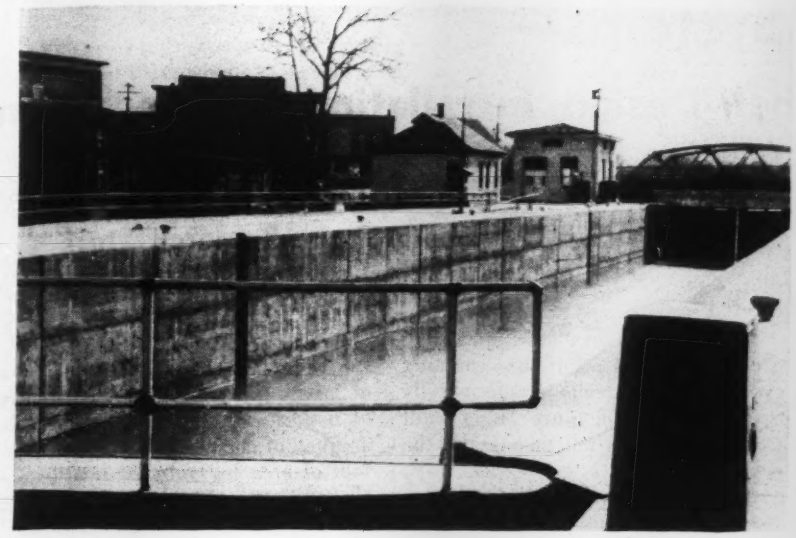
Because of the high lift involved, the miter gate on the downstream side of the lock is to be 105½ ft. high. It has a radius of 53½ ft. per leaf. The distance between low tailwater and the normal pool level constitutes the maximum head on the gate and is equal to 90 ft.

The skeleton of the gate is made of a series of arched ribs and vertical diaphragms covered by a skin plate. The ribs have variable spacing and are designed as two-hinged arches. To reduce dead weight, high tensile steel is used for the skin plate but the ribs and bracing are made of ordinary carbon steel. The diagonal bracing is designed to carry the entire weight of the gate, and to resist torsion caused by the operating strut.

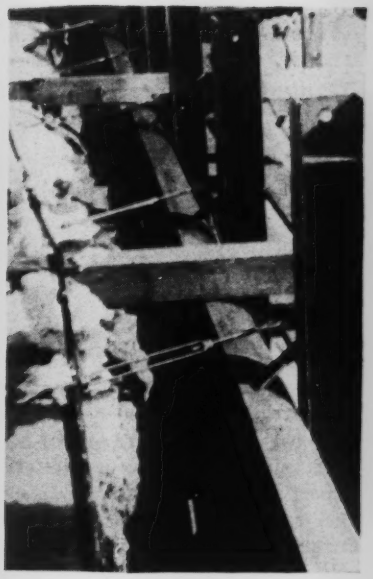
Each gate leaf will be operated by a 20-hp. electric motor through a train of gears, crank and connecting strut. The mechanism is designed to open or close the gate in 1½ min.

Lieut.-Gen. R. A. Wheeler is Chief of Engineers, Department of the Army. Col. O. E. Walsh is district engineer of the Portland District and the McNary design work was carried out in the district office under the direction of R. E. Hickson, head engineer; R. R. Clark, chief of the design branch; C. C. Galbraith, chief of the power plant design branch; and H. E. Brown, chief of the McNary design section. R. B. Cochrane is district hydraulic design engineer and was in charge of the model studies on the dam and lock. Lieut.-Col. W. J. Ellison is resident engineer and he will be assisted by Wm. B. Watson as chief of the construction branch, A. G. Davis as chief of the engineering branch, and J. R. Thatcher as chief of the townsite branch.

McNary Dam Contractors is a joint venture including the Guy F. Atkinson Co., Ostrander Construction Co., and J. A. Jones Construction Co. A. E. Holt is general manager, R. J. Jenks is project manager and A. G. Chaussee is head engineer.



NORTH WALL OF THE LOCK CHAMBER at Baldwinsville after the wrought-iron plates had been applied to the face.



TEMPORARY I-BEAM STIFFENERS and tie-bolts were used to position the plates accurately before concrete was placed between the old wall and the new facing.

New York Barge Canal Lock Walls Refaced With Wrought Iron

LOCK CHAMBER WALLS along the New York State Barge Canal are being resurfaced with wrought-iron plates whenever disintegration of the concrete makes major repairs necessary. A decision to put an iron facing on the walls was made in 1936 when it became necessary to repair the south wall of the chamber of Lock 24 near Baldwinsville, N. Y. In 1941 both walls at Lock 10 near Rotterdam were resurfaced; the following year similar work was done on Lock 23 near Brewerton, and early this year the north wall of Lock 24 was resurfaced. That work is shown in the accompanying photographs.

In the first two instances, $\frac{1}{2}$-in. plates were used; in the third undertaking, $\frac{1}{4}$-in. plates, and in the most recent work at Baldwinsville, $\frac{3}{8}$-in. plates were applied.

About 30 years old

The New York State Barge Canal was built in the period 1905—1918 when much less was known about making durable concrete than is known today. Concrete in the lock walls has disintegrated badly due to the fact that it is alternately wet and dry as a result of filling and emptying the lock chambers. Abrasion by passing barges also has been a contributing factor to the breakdown of the surface.

Work on the north wall of Lock 24 at Baldwinsville was begun last winter after the close of navigation. Holes about 16 ft. deep were closely drilled about one foot back from the face for the 300 ft. length of the chamber and dynamite was used to blast away the disintegrated concrete.

Large plates used

The $\frac{3}{8}$-in. wrought-iron plates were delivered to the job in 6x36-ft. sections, and three of these plates were welded together into a single plate 18x36 ft. before being set in place. The top plate in each section was bent on a $2\frac{1}{2}$-in. radius to form the coping, and ladder recesses were formed in the plates where required. Vertical joints were spaced to correspond to the expansion joints in the concrete wall.

To obtain an accurate alignment of the plates, vertical I-beams were attached temporarily to the outer face, being held at the bottom by butt straps cinch-anchored to the wall, and at the top by turn-buckle bolts for accurate adjustment. The plates were permanently anchored to the wall by wrought-iron bolts cinch-anchored to the wall and plug-welded to the plate. The space between the old wall and the new plates was then filled with concrete.

No paint is applied to the facing, the iron being left in its natural conditions.

Plates were fabricated in the Buffalo plant of Joseph T. Ryerson & Son, and were shipped by barge to the lock before navigation closed on the canal for the winter months. After each group of these plates had been welded into a complete 18 x 36-ft. wall section the temporary stiffening I-beams were welded to it. The section then was picked up by a crane operating along the top of the wall and lowered into place, the crane lines being hooked into holes cut in the upper ends of the stiffeners.

The Baldwinsville work was done by the New York State Department of Public Works, Chas. H. Sells, superintendent, B. D. Tallamy, chief engineer, and Guy W. Pinck, deputy chief engineer in charge of canal works, V. L. Ostrander, superintendent of maintenance, and Fred R. Lindsey, assistant superintendent of maintenance (canals).

Snow-Melting Systems—

Their Design, Installation and Operation

Results of a Three-Year Study by Members of the Research Staff of A. M. Byers Co., Pittsburgh, Pa.

MILLIONS of dollars are spent every winter for equipment and manpower to shovel, scrape, cinder or spread chemicals in an attempt to clear highways, sidewalks, loading platforms, airport runways and other areas each time snow falls or rain freezes on surfaces. These costly efforts give only temporary protection from the hazards and delays caused by snow or ice-choked surfaces.

Within the last few years, however, there has been an increasing use of heating pipes embedded in or under the pavement for "permanent" protection against ice and snow. Besides removing snow, such systems also solve the disposal problem. Water resulting from melted snow evaporates more readily on the warm pavement and is prevented from freezing.

The melting of snow and ice from all types of surfaces today is considered not only feasible but relatively easy to accomplish; it promises to be an efficient and economical method for removing and disposing of these materials. There are many installations so far on a small scale—residential driveways, sidewalks around commercial establishments and similar areas, and there is increasing interest in the use of these systems for roads, airport runways, loading docks and large ramps. The Oregon Highway Department is "winter-proofing" a highway grade separation at Klamath Falls (*ENR*, Oct. 30 1947, vol. p. 577) by embedding wrought iron pipes in the pavement and supplying them with natural hot water from a 250-ft. well nearby. A 600-foot long two-lane concrete road into a chemical plant near Pittsburgh is equipped with a melting system.

The data that follow are based on a study of more than 50 installations on which information is available. There are a number of other snow melting systems that have been successfully operated and many are being built this summer and fall throughout the country.

Design

One of the first factors to be considered in the design of a snow melting system is the magnitude of the melting job to be done.

The calculation procedure which follows is based on a recommended normal melting rate of 1 inch of snow per hour. Different melting rates can be obtained by revising the calculations proportionately. The amount of heat required to melt snow at the rate of 1 inch per hour may be determined by the following formula:

$H = A\ t\ d\ F$

H = Btu per hour (Btuh.)
A = Area to be melted (sq. ft.)
t = rate of melting (ft. per hour)
d = density of snow (lb. per cu. ft.)
F = latent heat of fusion of snow (or ice) (Btu. per lb.)

Three of the four factors in the above formula can be readily fixed, but the factor *d* is a variable since the density of snow varies widely, primarily depending on air temperature during snowfall.

In selecting a temperature that would represent an average value at which most snowfall occurs, U. S. Weather Bureau data were consulted. Records of ten weather stations regarding 27,823 snowfalls over a period of years, revealed that 87.5 percent of all snowfalls occurred in a temperature range of 10 deg. F to 35 deg. F. The mean temperature in this range was 26 deg. F. Consequently, to fix the density of snow at a constant average value for calculations, its density at 26 deg. F. was used. The average density of snow at 26 deg. F. is about 6 lb. per cu. ft. Using this figure, a melting rate of 1 inch per hour, and a latent heat of fusion of 144 Btu per pound, the amount of heat required per square foot of area for only the melting job becomes: $H = 1 \times \frac{1}{12} \times 6 \times 144 = 72$ Btuh. (per sq. ft.)

Past experience suggests an efficiency of 70% for such a system. With 72 Btuh. per sq. ft. required for melting, addition of downward and edgewise loss factors results in a total input of about 100 Btuh. per square foot of surface to be cleared.

On the assumption that the surface temperature of the snow will closely approach air temperature, it is not considered necessary to make any allowance for loss of this type. Both experience and test work have indicated equipment sized on the basis of 100 Btuh. per sq. ft. to be adequate for one inch per hour removal, so that figure may be considered acceptable for practical design purposes. In sizing boilers or other heating units the total heat calculated by the use of 100 Btuh per square foot represents only the net boiler output. Standard allowances for pick-up and piping losses should be added to obtain the gross output.

Pipe Spacing

With the amount of heat required for the melting job satisfactorily estimated, the next step is determination of pipe size and spacing. Several years ago, the use of 1¼" pipe on 18" centers or 1" pipe on 15" centers was considered an economical design for providing a relatively uniform melting action at the surface. While such spacing obviously causes melting to occur first immediately above the piping, the lag in the areas between the pipe runs has never been reported to be great enough to be

objectionable. These spacings, however, should be considered maximum for the two pipe sizes. Closer centers can be utilized where more uniform melting is desired.

Current engineering practice is centered on an average water temperature of 160 deg. F. with the temperature drop through the system varying from 10 to 30 deg. F. depending on melting area and permissible pumping head. The average installation should allow a maximum drop of 20 deg.

While some industrial applications have utilized steam, this practice is not considered the most desirable for a number of reasons. Except for systems where a continuous flow of waste steam is available, there exists the danger of condensate freezing at the start of a melting operation.

In addition to this disadvantage, the use of intermittently flowing steam presents an expansion problem due to excessive temperature differences when steam is first injected on a cold day. The installation of economical heat exchangers to provide hot water from existing steam lines seems to be the desirable practical solution.

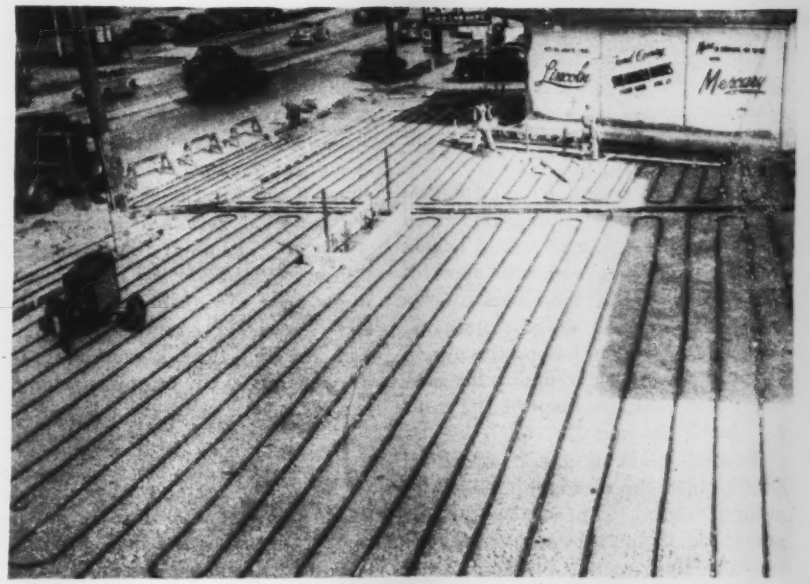
The majority of installations use a separate boiler, or steam convertor, to provide hot water for snow melting. In some cases it would be possible to use hot water from the same boiler that is employed for space heating, without overloading. Most heating systems are designed on the basis of 0 deg. F. outdoor temperature. Since records show nearly always falls in the 20 deg. zone the Btu output not required for space heating could be switched satisfactorily for snow melting.

Installation

The question most frequently asked when snow-melting installation methods are discussed concerns location of the piping with respect to the surface of the area to be cleared.

While faster melting action and a somewhat more efficient system may be obtained with piping near the surface, such practice introduces the problems of concrete fracture and damage to piping from heavy loading. The problem of concrete fracture from rapid expansion of the piping is not as readily handled as in the case of radiant heating, because with snow melting systems much greater temperature differences are involved, particularly with intermittently operated systems.

Installation records indicate that by far the majority of systems consist of piping placed on top of a prepared fill or base over which the concrete or asphalt is poured. This normally results in pipe embedment to the extent of 75 percent or more in the slab material. Where a loose stone fill is employed, the concrete may work its way completely around the piping and underneath to a depth of an inch or more. Such systems, both intermittent hot water and continuous steam, have operated under severe weather conditions without vis-



CONSTRUCTION—Area snow-melting system at an auto agency-filling station in Portland, Maine, uses combination sinuous coils and grid.

THE RESULTS—After a heavy snowfall, driveway of the Portland installation is clear of snow. The banks piled at the curb were shoved there by street snow plows.

ible detriment to concrete, asphalt or the wrought iron pipe used.

Burying pipe in the fill beneath a slab should eliminate all danger of slab fracture. But it also will reduce somewhat the melting action and efficiency.

It has been found by observation that a system with piping embedded at the center of a 4″ slab heated rapidly enough to make the lines of the coils visible five minutes after a cold start beneath a light snowfall. An adjacent system having the piping in sand immediately under the slab did not reveal the lines of the coils for nearly an hour.

From both heating and structural standpoints, the disadvantages of installing piping either close to the surface or in the fill beneath the slab indicate that piping placed on the fill and covered with paving material meets all necessary requirements for an average snow melting system.

Good concrete practice normally calls for a minimum slab thickness of 4 in. for sidewalks and 5 in. for driveways and other areas subject to light loads. Highways, loading zones, etc., normally require 6 in. to 8 in. or more. A concrete authority has suggested 2½ in. as the minimum thickness of concrete above the piping. This cover is possible with pipe sizes up to 2 in. and slab thicknesses not less than 5 in. With a 4 in. slab, the use of 1¼ in. pipe will result in a cover of 2.3 in.

The question of damage to embedded pipe from heavy surface loading can be answered only by experience. In a number of field investigations, it was found that 5 to 10-ton power rollers had been used to level and pack asphalt poured over wrought iron snow melting pipes and no damage occurred. In one case, trucks up to 15 tons gross weight were driven over an asphalt roadway without causing pipe failure. Thus, unless an unusual loading condition exists, it can be assumed that the possibility of pipe failure from crushing is a remote one.

Outdoor concrete work normally calls for numerous expansion joints, although structural engineers are reported to be obtaining good results with fewer joints than were normally specified in the past. However, when full expansion joints are planned for concrete, the use of wrapped expansion loops may be feasible. When a procedure for contraction or construction joints is involved, the use of pipe wrapping or keyed or doweled slabs may be considered, although it is not a certainty that any special steps of this kind need be taken.

Additional points concerning installation include: fabrication by welding to provide the most durable joints, and the avoiding of cinders, slag, and other sulfur-bearing materials for fill. Broken stone or gravel are considered the most desirable for this purpose.

Operation

One of the major problems under the heading of operation is whether to operate a snow melting system continuously or intermittently.

With steam as the heating medium, engineers are of the opinion in most instances that intermittent operation is dangerous because of the possibility of condensate freezing during the starting-up period and the danger of excessive expansion of solidly embedded piping. Continuous steam flow will practically eliminate these disadvantages, but can only be justified from a cost standpoint if waste or exhaust steam is available. Continuously operated steam systems are among the most successful from a melting standpoint since the slab is always well above freezing, and snow, even in the case of abnormal snowfalls, never accumulates on the surface.

While continuously-operated hot water systems would most closely approach the effectiveness of continuous steam flow, water systems almost always are recirculated systems. Operation of the heater and circulator units is a major cost factor in these.

Normally, continuous circulation of hot water is not practical. A compromise between intermittent and continuous operation would be to maintain moderate heat when snow is predicated, and then to increase the temperature as snow starts to fall.

When it is desired to operate a hot water system only when snow is falling, or has fallen, on the slab surface, the use of a "snow detector" may be practical. This device depends on accumulation of snow on a sensitively balanced metal plate, the depression of which operates an electric switch which energizes the pump starter, heater control or other electrical circuits as desired by the operator.

Anti-Freeze compounds

Up to this point no mention has been made of the use of anti-freeze compounds to prevent the freezing of hot water in a snow melting system. While there are a number of chemicals which can be added to water to produce a low freezing point solution, the most practical and popular appear to be ethylene glycol base solutions. There are at least two of these available commercially and since they have almost identical anti-freeze properties, the choice between the two products is the responsibility of the designer.

It should be mentioned that ethylene glycol is toxic and therefore no permanent connection should be made between the snow melting system and potable water systems. While an automatic fill-up valve used in conjunction with a check valve might prove foolproof, the possibility of valve leakage and backflow into a domestic water system makes it sound engineering practice to break the water supply connection after initial use and then manually fill the system with the required amount of anti-freeze. With small systems, manual filling with both water and anti-freeze is practical as a method of operation.

N. J. Highway Department Salvages Many Trees and Shrubs

Native plants preserved in the construction of New Jersey's First Parkway, Route 4 in Union and Middlesex counties, have an estimated value of $105,000, Oliver A. Deakin, Parkway engineer, reports.

The trees and shrubs formerly growing on the graded width of the new artery have been replanted for what Highway Commissioner Spencer Miller, Jr., has described: a "parkway through a park." The design has been completed on the 10 miles from Cranford Township, Union County, to Woodbridge Township, Middlesex County, where grading and bridge contracts are at various stages of completion.

Notes on Legal Decisions

Summaries of decisions relating to construction prepared by I. Vernon Werbin, counselor at law and engineer, New York

General Rules Applicable to Construction Contracts

In every contract there exists an implied covenant of good faith and fair dealing—neither party shall do anything that will have the effect of destroying or injuring the right of the other party to receive the fruits of the contract [1].

Where the language of an instrument that is the subject of a dispute is ambiguous or doubtful, it will be construed against the party who drew it. This is done on the assumption that he could have avoided any misunderstanding by the use of language that would have clearly expressed the intent of the parties[2].

Where a contract is ambiguous or indefinite, courts will give great weight to the practical interpretation given to the contract by the parties thereto[3]. Where the language of the contract is clear and unambiguous, the practical interpretation given to it by the parties will not be considered [4].

A contract must be construed as a whole and not in detached parts[5]. It is well-settled law that a contract provision cannot be construed without regard to the rest of the instrument of which it is a part. The intent of the parties must be determined from the entire instrument [6].

The validity of a contract is to be determined by the law of the place where the contract was made[7].

Courts will construe contracts as they are made and will not make a new agreement for the parties by construction[8].

New York law holds with the general principle that if a contract contains two antagonistic clauses, the first clause will prevail and the latter one will be rejected [9].

The words of a contract are to be construed in their ordinary and grammatical sense[10].

In case of a conflict between the written and the printed portions of a contract, the written parts will prevail [11]

In a conflict between the provisions of the contract and those of the specifications, the contract provisions prevail [12].

Every contract implies good faith and fair dealing between the parties to it. The courts avoid, if possible, any construction that is unreasonable or inequitable, and especially one that will place one of the parties at the mercy of the other[13]. Contractual obligations are fixed solely by the parties, and the language of a business contract must be construed in the light of what a business man would reasonably expect to give or receive, to perform or suffer, under its terms[14]. In transactions of business life, sanity of end and aim is at least a presumption, albeit a subject to be argued [15]. A contract will not be construed so as to render it oppressive or unequitable as to either party, or so as to place one of the parties at the mercy of the other, unless it is clear that such was their intention at the time the agreement was made[16].

Every word and phrase in a contract should be given a meaning and significance according to its importance in the context of the contract. Courts are not warranted in reading out of a contract words or phrases placed there by the contracting parties, unless they cannot be rationally fitted into the scheme of the agreement between the parties[17].

As an aid in discovering the intent of the parties to the contract, the court may look to the circumstances of making an agreement. This may include the preliminary negotiations between the parties, and thus place the court in the same situation as the parties at the time of contracting. Also applicable here is the familiar rule that when the contract is ambiguous, a construction given to it by the acts and conduct of the parties before controversy has arisen as to its meaning, is entitled to great weight, and will, when reasonable, be adopted and enforced by the court. Such a practical construction placed by the parties on the instrument is recognized as the best evidence of their intention[18].

The performance of a contract is governed by the law of the place where the contract is to be performed; the remedy by the law where the suit is brought; all matters which bear upon the execution, interpertation and validity of the contract are determined by the laws of the place where it is made[19].

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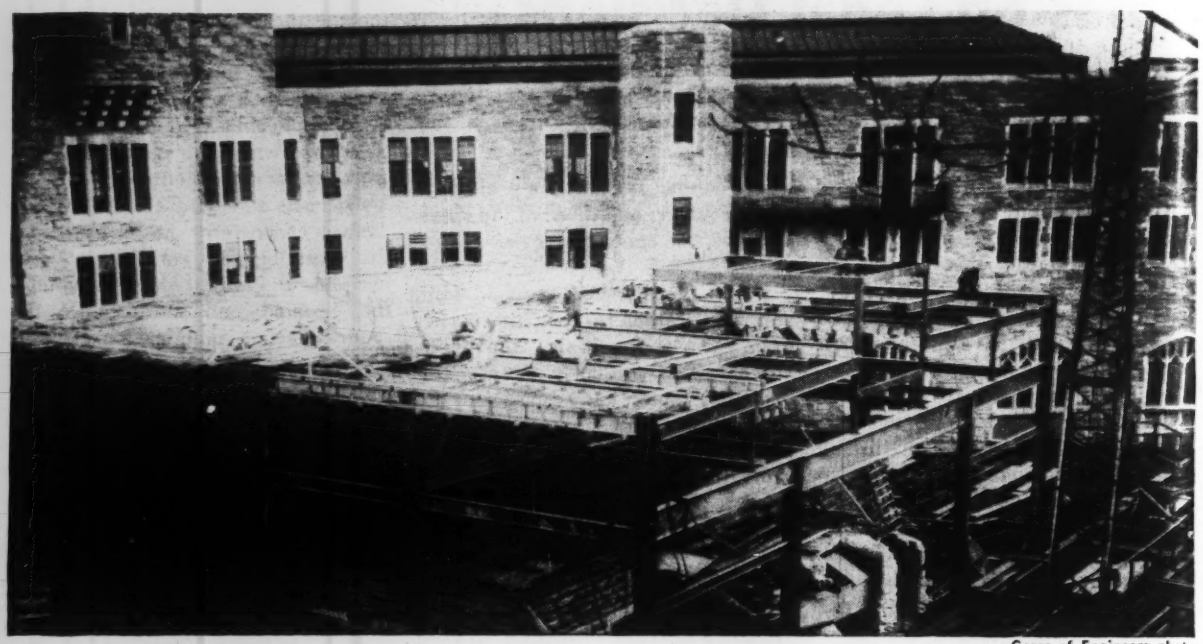
(1) Kirke La Shelle Co. v. Paul Armstrong, 263 N.Y. 79, 188 N.E. 163.
(2) Kristall, et al., v. General Produce Co., Inc., 47 N.Y.S. (2d) 161.
(3) Stewart, et al., v. Barber, 43 N.Y.S. (2d) 560.
(4) In re Chicago & E. I. Ry., 94 F.(2d) 296.
(5) Empire Properties Corp. v. Manufacturers Trust Co., 288 N.Y. 242.
(6) In re Wisconsin Central Ry. Co., 68 F. Supp. 320.
(7) Bitterman v. Schulman, 39 N.Y.S. (2d) 495, 265 App.Div. 486.
(8) Sanberg v. Reilly, 223 App.Div. 57, 227 N.Y.S. 418.
(9) Eliscu v. Fiber, 157 F.(2d) 136.
(10) Halpern v. Amtorg Trading Corp., 39 N.Y.S. (2d) 907; O'Connor v. Great Lakes Pipe Line Co., 63 F.(2d) 523.
(11) New York Life Ins. Co. v. Hiatt, 140 F.(2d) 752; Barhydt v. Ellis, 45 N.Y. 107.
(12) McGarry Contracting Co., Inv. v. Board of Education of the City of New York, 284 N.Y. 218, 30 N.E. (2d) 482.
(13) Simon v. Etgen, 213 N.Y. 589, 107 N.E. 1066.
(14) Shiral v. Blum, 239 N.Y. 172, 179, 146 N.E. 194, 196.
(15) Outlet Embriodery Co., Inc. v. Derwent Mills, Ltd., 254 N.Y. 179, 183, 172 N.E. 462, 463, 70 A.L.R. 1440.
(16) Campbell v. State, 240 App.Div. 304, 270 N.Y.S. 222.
(17) Basler v. Warren, 159 F.(2d) 41.
(18) Universal Sales Corp. v. California, etc. Mfg. Co., 20 Cal. (2d) 751, 761, 128 P.(2d) 665, 671, quoted with approval in Jegen v. Berger, 174 P.(2d) 489, 494.
(19) Brown v. Ford Motor Co., 48 F.(2d) 732, 734.

Basementless 2-story House Uneconomic

Elimination of the basement of a two-story house with substitution of equivalent space above ground is more expensive than provision of a basement. This is the conclusion reached in the last installment of a three-part article in Technical Bulletin No. 5 of the Housing and Home Finance Agency.

The basement of a one-story dwelling, however, can be eliminated with considerable saving (*ENR*, May 13, vol, p. 723). The additional cost in the case of a two-story house is accounted for by the fact that a full basement represents a considerably larger proportion of the total volume of a one-story residence than of a two-story house of comparable living area. Also, the type of foundation selected as suitable for a two-story basementless dwelling is more expensive than the foundation considered adequate for a one-story house.



Corps of Engineers photos

FIG. 1. IN EXPANDING the cadet mess hall at West Point, a new section was built completely over and around the old.

Mess Hall Extended While Cadets Dine

EXPANSION of the cadet corps of the United States Military Academy has required a corresponding extension of many facilities at West Point. The first and most difficult job was the enlargement of the Cadet Mess.

To increase the capacity from 1,960 to 2,496 cadets, a portion of the building had to be replaced by a section that added an 80 x 105-ft. dining room and space for related activities. But demolition and new construction had to proceed without interrupting food preparation and service—functions that are carried on from 8 to 16 hours per day.

The Cadet Mess is in five-story Washington Hall. The dining hall, kitchen and scullery are on the first floor. Drafting and lecture rooms occupy the upper stories. Cadet stores, arsenal, linen room, employees lockers and toilets, ice-making room, and various food, refrigeration and dry-storage areas are located in the basement. Supplies are brought in from a loading platform at this level.

The one-story and basement addition, which costs about $2,000,000 and added about 74,000 sq. ft. of floor area, was built generally of the same type of material as was used in the existing structure. It has a structural steel frame. Floors are reinforced concrete with quarry tile finish in kitchen and basement, ceramic tile in toilets, slate in the dining hall.

The exterior walls are random-size rubble granite, up to 20 in. thick, and match the color, texture and size of the stone in the existing building.

Most interior partitions consist of terra cotta block faced with salt-glazed tile. A major exception is the dining hall section, which has panelled oak wainscoting around its perimeter to a height of 12 ft., and plaster and limestone trim above.

Ceilings in the basement are plaster. In the kitchen and dining hall, ceilings are acoustic tile.

These purlins are 12-in. WF 25-lb. beams. About 20 ft. long, they are spaced at 8-ft. intervals and supported on 78-ft. long steel trusses that have T-beam upper and lower chords. The trusses are 7 ft. 6 in. deep, out to out, and provide a clearance under the bottom chord of about 35 ft.

The dining-hall roof is about 26 ft. higher than the roof over the rest of the new section. Both roofs consist of a 4-in. reinforced concrete slab with 2 in. of insulation and ½-in. mortar topping. The high roof has a built-up tar-and-slag covering; the low area is surfaced with promenade tile.

To make room for the expansion of Washington Hall, a rock ledge adjacent to the building was blasted away to a width of 30 ft. and a height of 60 ft. An approach road was then constructed through a sally port at that end of the building to provide access to the loading platform at basement level.

Success in building the extension without interrupting mess functions was achieved through careful planning. Conferences on proposed methods of construction were held weekly between the contractor's key personnel and representatives of the Corps of Engineers. The week's program agreed on was then submitted to the mess manager for approval.

Credit is given mainly to two procedures for enabling construction to continue without halting mess functions. One was the erection of temporary partitions to isolate working areas (Fig. 2). The second was the building of the new section completely over and around the part of the existing structure that was to be

replaced (Fig. 1). Not until the new addition was finished were the walls and roof of the old portion removed.

To erect the new section, it was necessary to insert new columns in the existing structure. For this purpose, 2-ft. square holes were cut in the floors and roof, permitting the steel columns to be lowered in sections about 25 ft. long, to prepared concrete foundations on rock. Then, beams were slid through holes in the existing wall and connected to the columns to brace them.

The steel was placed by means of a 20-ton crane with a 100 ft. boom, which operated from the first-story level of the new steel around the outer perimeter of the existing wing.

The most intricate problem was to provide an entrance to the new dining hall from the old. The design called for a 20-ft. 6-in. wide central opening, flanked by two 11-ft. 9-in. openings, each 32 ft. high. This necessitated removal of wide areas of the existing heavy granite wall in the five-story portion of the building. Thus, it was necessary to provide supports above the new arches for the upper four stories.

The procedure for providing this support was: A hole was cut in the wall just above the plane of the high-roof framing, and one end of a needle beam was inserted, using a 27-in. or 36-in. WF beam near the face of the wall as a fulcrum (Fig. 3). At the opposite end, shims were placed between the needle and the tie-down beam to which it was bolted to keep that end raised 2 in. The masonry was then replaced around the beam and the bearing plates on top of the needle grouted. After the grout had hardened, the procedure was repeated for the other beams.

When the structure had been permanently connected to the needle beams, the temporary shims were removed. Then, the bolts at the tie-down beam were drawn down 1/2 in. at a time at successive needles. Lock nuts were placed on these bolts and the threads nicked. Finally, the masonry below the needle beams was removed and the new arches built.

The needle beams were left in place to provide permanent support for the wall over the arches. Thus, it was unnecessary to re-transfer load from needle beams to new supports.

FIG. 2. THE EXISTING DINING HALL was shielded from construction activities by dustproof plywood partitions (at left).

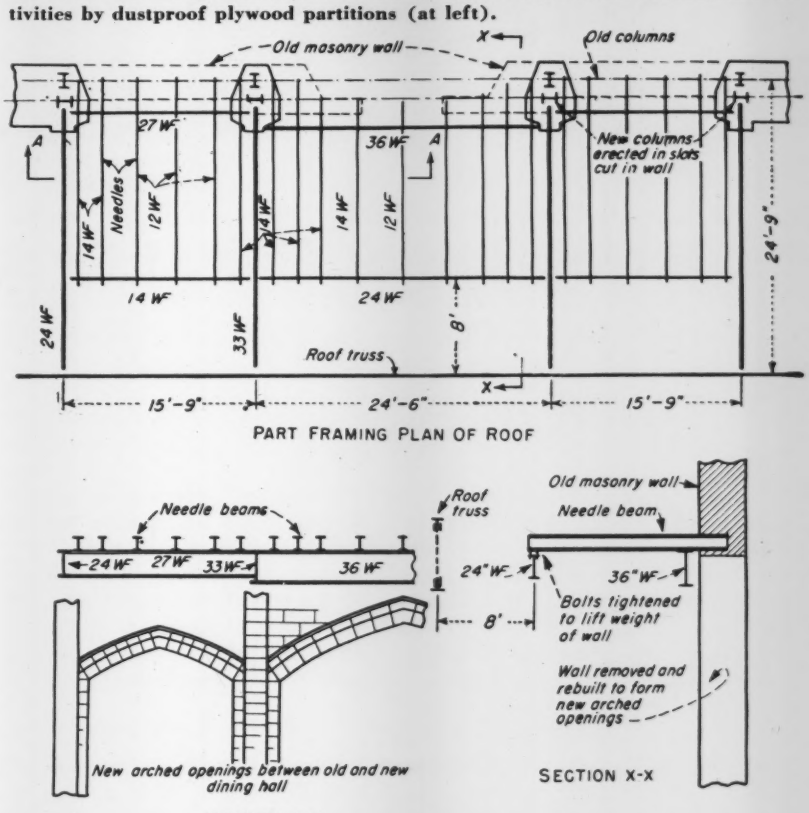


FIG. 3. DETAILS of the new structural framing in the vicinity of the wall in which arches were cut are shown in plan and section.

Placing the stone for these arches was no simple task, since each stone weighed 2 tons. The job was accomplished by use of three-ton chain blocks supported from existing steel to raise the stones to stages from which they slid into place on rails.

Enlargement of the cadet mess started in June, 1946, and was completed in the summer of 1948. Architects were Delano & Aldrich, and structural engineers were Weiskopf & Pickworth. Anthony M. Meyerstein, Inc. was the contractor, with Theodore Porawski in charge. Col. Charles S. Williams was district engineer and J. A. Rooney chief, Military Construction Division, of the New York District. Lt. Col. J. C. Lowry is engineer in charge at West Point, N. Y., and John P. Horgan was project engineer.

Old buildings are wrecked to . . . **Make way for new** memorial office as . . .

Detroit Builds First Unit of Civic Center

SETTING THE PACE in contemporary architectural design, for what ultimately will be its multimillion-dollar civic center development, Detroit has awarded all of the construction contracts for the first unit—a ten-story, Veterans' Memorial Building. Complex foundations are a distinguishing feature of this job.

When fully developed, the civic center will occupy a 16-block area in downtown Detroit at the foot of Woodward Ave., between Larned St. and the Detroit River, and between Cass and Randolph Streets. Other major units planned for eventual construction include a convention hall of 20,000 capacity, civic auditorium, state and federal buildings, city-county office building, and substantial parking facilities both above and below ground.

The site chosen for the memorial building was secured by the city, mostly by condemnation, at a total cost of $630,000. Ten large buildings were demolished by the Department of Public Works, at a cost of $50,000.

O. W. Burke Co., Detroit, completed a $100,000 contract this spring covering foundation excavation, pile driving and caisson construction. Kuhne-Simmons Co., Decatur, Ill., general contractor on the project, started construction on May 10, under a $3,690,000 contract. A third contract for $261,700 covering the furnishing and erection of 1,200 tons of structural steel was awarded to Whitehead & Kales, Detroit, and steel erection was started Aug. 19.

Total cost of the building, including the cost of the site and demolition of existing buildings, is $4,732,000, which will be paid out of the city's capital improvement budget.

Ten-story, steel-framed.

Principal function of the memorial building will be to furnish headquarters for all veterans' organizations. It is to be of steel-frame construction, faced with white marble—either Georgia or Vermont. The building is to be L-shaped with the main portion 64 ft. wide, 184 ft. long and 10 stories high, facing on what is now Shelby St. The other wing, 87x105 ft., will be only two stories.

Air-conditioning will be installed throughout and all major rooms in which large expanses of glass are used for enclosure will have radiant heating.

Briefly, the functional layout includes: kitchen and cafeteria in the basement; a 100x65-ft. ballroom and a 70x60-ft. banquet room on the first floor; and a 70x60-ft. memorial lounge on the second floor. The next two floors will provide headquarters offices for the veterans' organizations, followed by four floors of meeting rooms, including a small dining room on the 8th floor, and one floor for air-conditioning and elevator equipment. The 10th floor will house offices of the Memorial Hall Commission and a 60x26-ft. penthouse, glass-enclosed on three sides, with a terrace on the south side overlooking the Detroit river into Canada.

Step-tapered piling.

Foundations are spread footings on cast-in-place, step-tapered concrete piles, and cast-in-place concrete caissons. Piling were driven 100 ft. to refusal on hardpan to carry a maximum design load of 50 tons each. The bottom 40 ft. of each pile casing is a closed-end, $10\frac{3}{4}$-in. O.D. welded steel pipe, with 0.279-in. wall. The remaining upper portion is a step-tapered corrugated steel shell—all filled with transit-mix concrete designed for 3,000 lb. 28-day strength.

One unusual feature of the foundation design was the necessity of using 15 cast-in-place concrete caissons to carry all column loads in the banquet room area at the north end of the building. Piles were not permitted in this area due to the proximity of a large interceptor sewer that could not be diverted. It was feared that vibrations from driving the piling might damage this sewer.

Since this area contained no basement, the caissons were sunk about 115 ft. from ground surface to hardpan. Caissons varied from 4 to 6 ft. in dia., and were belled-out on the hardpan to diameters ranging from 7 ft. to 11 ft. 4 in., to carry maximum design loads of 10 tons per sq. ft.

Caissons bored by "quick-drilling".

Caissons were sunk by a quick-drilling method that permitted boring and concreting one caisson, complete, in three 8-hr. shifts. They were drilled inside a set of nestable casings of 2-in. diminishing diameter for each 16-ft. section.

Drilling was by a crane-mounted special rotary drill with expansion auger, mounted on the bottom of a telescoping spline shaft, and operating inside of the nestable casings. The belled-bottoms of caissons were excavated by hand. Both the drilling and concreting of the caissons were carried out so that no portion of a drilled hole would be unprotected from caving.

After a hole had been drilled, belled out, and foundation material cleaned and leveled, concrete was deposited to form the caisson. As the hole was filled, the nestable casings were retracted—each section telescoping into the one immediately above. An air-hoist, with steel-frame tripod mounted over the caisson, handled the concreting chutes and removed the nestable casings.

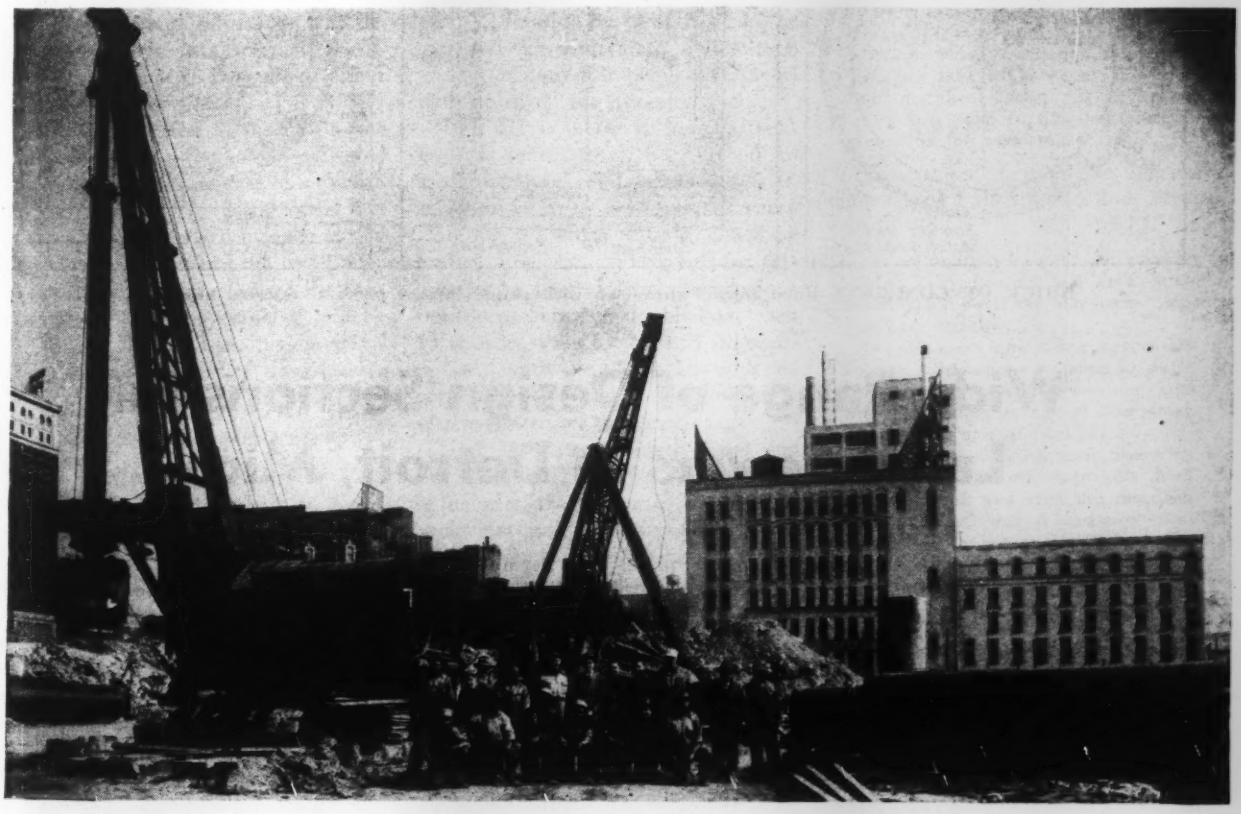
Largest structural steel members in the building are double 7½-ft. deep steel trusses, spanning 61 ft. over the banquet room to carry the upper eight floors of that portion of the building. Each pair of trusses carries column load of 776 kips at their one-third points. End reactions are carried to caissons by 14-WF., 287-lb. steel-beam columns.

Architects and engineers.

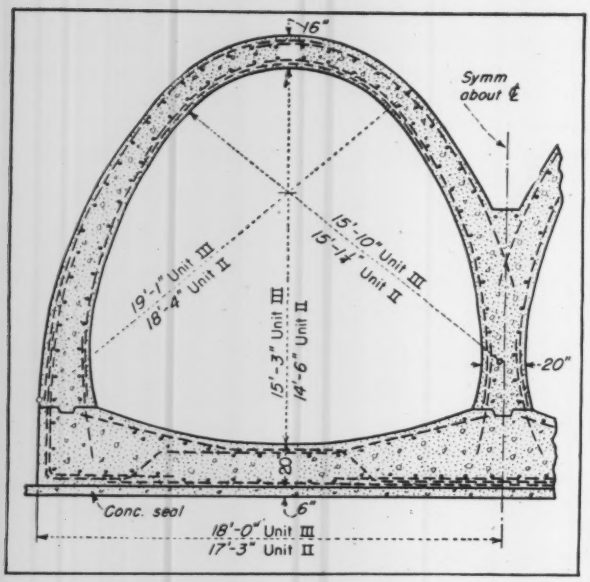
Harley, Ellington and Day, of Detroit, architects on the project, prepared plans and specifications for the Veterans' Memorial Building and are supervising construction. Benson J. Wood is chief structural engineer; Malcolm R. Stirton, in charge of architectural design; and Raymond C. Mauck, field superintendent.

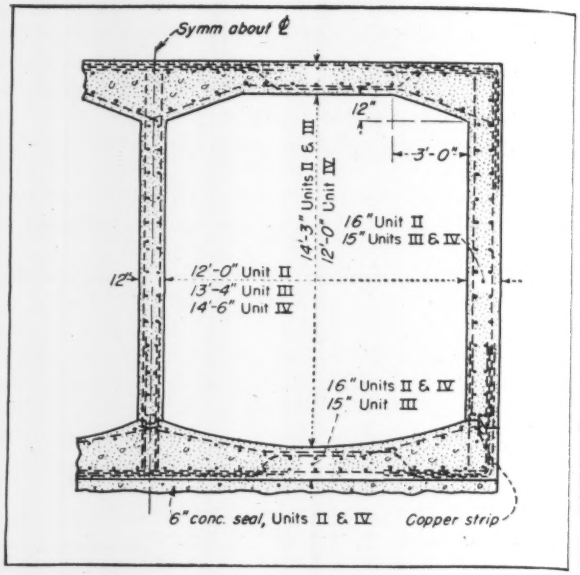
The Raymond Concrete Pile Co. drove the piling and constructed the caissons. Alex Howie is superintendent of construction for Kuhne-Simmons Co., and Carl G. Seasword is field engineer. Ed Allen is superintendent of steel erection for Whitehead & Kales.

John W. Libske is director of the Memorial Hall Commission, and George R. Thompson, city engineer, has overall direction of the complete project.

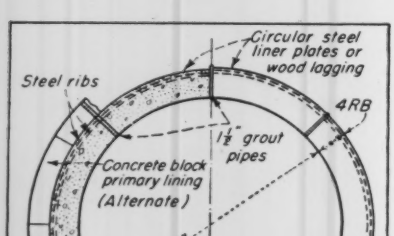


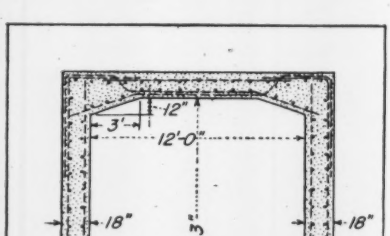
BELL-BOTTOM CAISSONS were sunk 115 ft. to hardpan by a special rotary drill, with expansion auger, drilling inside of nestable, telescoping casings. Casings were retracted as bored holes were filled with concrete.

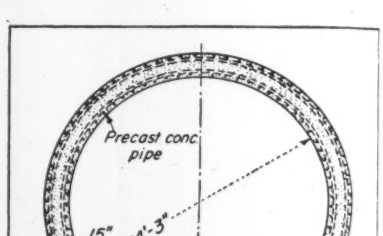




DOUBLE ARCHES vie with double boxes or twin precast concrete pipe, while . . .







BRICK OR CONCRETE lined tunnel competes with single box or precast concrete pipe in . . .

Wide Range of Design Sections for Large Sewers in Detroit, Mich.

BIDS are to be received Oct. 12 by Detroit, Mich. for the construction of 18,690 lin. ft. of large-diameter stormwater relief sewers. Neither the size of the sewers nor the length of the project are of special significance. But provisions incorporated in the design for adapting the work to fit available equipment and construction methods employed by sewer contractors interested in the work is a fresh approach to reducing contract-bid prices by permitting the contractor as much latitude as possible in selecting the type of sewer he is best equipped to build.

The overall project, which is one continuous line of sewer, has been divided into four units. This will permit the individual contractor to bid on any one unit, while the larger contractor or a combination of contractors will be able to bid on more than one or on all four units.

Real economy in bids to be received is expected from the variety of alternate design sections prepared and specified in the work. Lump-sum bids will be received for each of the four units, with the successful contractor selecting the type of sewer he will build, from the alternate design sections prepared by the city's engineering department, headed by George R. Thompson, city engineer. After the sections of the sewer are

determined, a subsequent contract will be awarded for the transitions at the junctions.

As shown in the accompanying sketch, the sewer will extend from Tireman Ave. and Greenfield Rd., on the west side of Detroit, south to discharge into the Rouge river. It will serve as a combined sewer for stormwater and sanitary sewage. During dry-weather flow, a diversion baffle to be built in the sewer will divert all sanitary sewage into an existing sewer leading to the Dearborn (Mich.) sewage treatment plant. During heavy rainfall sanitary sewage and stormwater will discharge directly into the river. When completed, the 3½-mi. of sewer will afford much-needed storm relief for residential areas on the west side of Detroit.

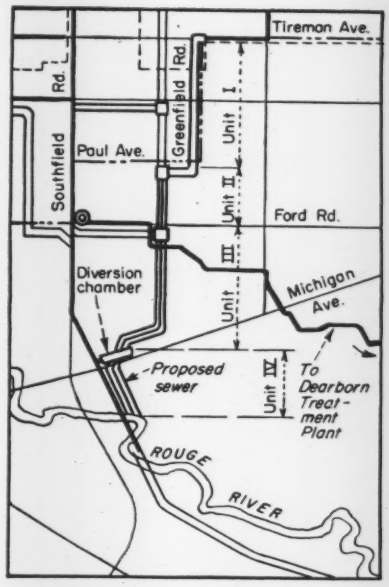
Unit I of the project, covering 5,360 ft. of sewer, from Tireman Ave. to Paul Ave. is specified to be tunnel construction due to its invert being 35 to 45 ft. below ground, in unstable material ranging from soft blue clay to saturated sand. It is to have an inside diameter of 14 ft. 3 in., cylindrical in shape, and designed to carry 1,060 cfs. Specifications permit it to be built of either concrete or brick.

Unit II includes 2,400 ft. of line running west in Paul Ave. followed by 2,530 ft. of sewer extending south to Ford Road. The 2,400 ft. of line may be constructed all in open cut or partly in open cut and the remainder in tunnel at the discretion of the contractor. If built in tunnel it will be cylindrical, 14 ft. 3 in. inside diameter and may be either concrete or brick construction.

Large precast concrete pipe

Any portion of this part of Unit II that the contractor elects to build in open cut is specified to be one of three alternates. They are: (1) 14-ft. 3-in. dia. precast concrete pipe; (2) reinforced concrete box 14 ft. 3 in. high by 12 ft. wide; and (3) an equivalent single-arch section of poured-in-place reinforced concrete of size shown on the design drawings.

The 2,530 ft. of Unit II will all be in open cut. It is designed for a discharge of 2,120 cfs. and the contractor has a choice of three alternate design sections: (1) two lines of 14-ft. 3-in. dia. precast concrete pipe; (2) a reinforced concrete double-box, each 12 ft. wide by 14 ft. 3 in. high; and (3) an equivalent double-arch section of poured-in-place concrete of size shown on the drawings.



STORMWATER RELIEF on the west side of Detroit will be afforded by construction of 3½ mi. of large sewers. Project is divided into four units to secure maximum contractor interest.

Unit III is 6,860 ft. long, extending on south from Ford Road to Michigan Ave., then about 1,400 ft. southwest. It is designed to carry 2,380 cfs. of storm water and will be built in open cut. Plans call for this unit to be one of two alternates—a reinforced concrete double-box, each 13 ft. 4 in. wide by 14 ft. 3 in. high, or an equivalent double arch of poured-in-place reinforced concrete of size shown on the drawings.

Unit IV extends south from the end of Unit III to the Rouge river. It includes one diversion chamber, a backwater gate structure, and 1,540 ft. of sewer designed for a discharge of 2,380 cfs. No alternates are permitted for this section of line. It is to be a reinforced concrete double-box, each 14 ft. 6 in. wide by 12 ft. high.

Part of four-year program

The entire 3½-mi. sewer project is required to be completed in 16 mo. after contractors receive notice to begin construction. It constitutes a substantial portion of Detroit's $45 million sewer program begun last year and scheduled for completion by July 1, 1951.

How to Handle Northern Hard Maple Flooring

Suggestions for handling Northern Hard Maple flooring are included in a recent release of the Maple Flooring Manufacturers Association.

Instructions for storing flooring in warehouses are as follows:

Do not unload in rain, fog, or during excessively humid conditions.

Do not store flooring in leaky enclosures.

Do not pile on floors that are less than 18 inches from the ground and that haven't good air circulation underneath.

Do not use storage space near the end of the building—even though storage bins are protected by doors. Doors that are frequently left open are bad for flooring in rainy weather.

Provide protected ventilation to minimize relative humidity. Still, damp air is harmful to dry flooring.

Choose the sunny side of a building for flooring storage bins, and see that the weather-proofed windows are clear to let sunshine through. Sunshine increases capacity of air to take up moisture, which ventilation removes.

Do not take a chance at unloading flooring without shelter. It is cheaper to truck it back to the shed than to gamble on the weather over night.

Precautions directed to general contractors, builders and floor layers are:

Do not lay flooring until the building is dry. Dry flooring laid in a damp building will swell and may cause "cupping" or "buckling."

Do not under any circumstances lay flooring tight against studding or walls. Provision for an expansion joint (the width depending on size of floor area) is safeguard against buckling.

Do not lay flooring until plastering and cement work are thoroughly dried and woodwork and trim are installed. Laying and finishing of hardwood floors should be the last operation in building construction.

Do not lay flooring in a cold, damp building. As a final precaution, heat the building for ten days to at least 70 deg. This means heat even in the summer and early fall.

Do not stack bundles too close together or in solid piles and avoid unheated rooms. Air circulation around each bundle draws off absorbed moisture taken on after leaving the factory.

Do not close windows. Windows open at the top aids in driving out moisture through air circulation.

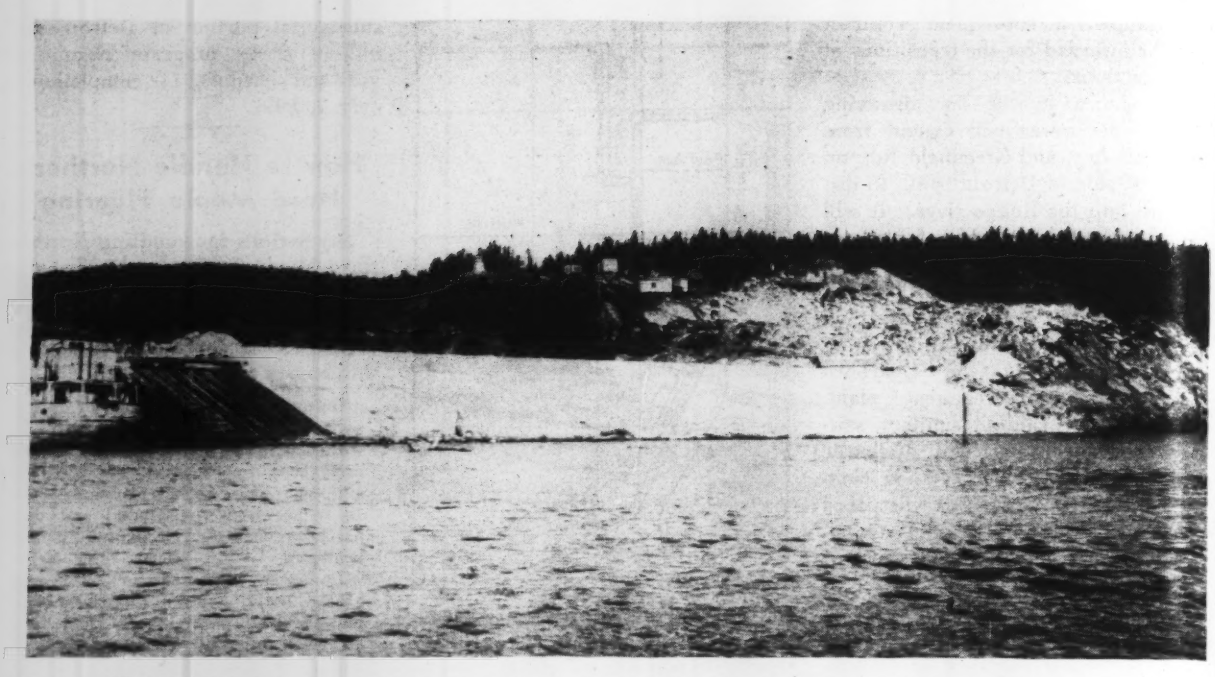


FIG. 1. BREAKWATER at Forestville, Quebec, that was sheathed with quarry-run rock grouted in place.

Grouted Fill Protects Breakwater

Robert F. Legget
National Research Council, Ottawa, Ont.
and
Peter A. Harakas
Anglo Canadian Pulp and Paper Mills, Ltd., Forestville, Que.

SUCCESSFUL performance of a small rock-mound breakwater at Forestville, Quebec, after its three year's exposure to the storms and ice of the Gulf of St. Lawrence gives promise of the general utility of a new method of construction for this important type of marine structure. Normally, to prevent movement by wave action of loose rock in rock-fill breakwaters, the fill is capped off by rocks too heavy to be moved. At Forestville, construction limitations made it impracticable to place capping rock of the 10-ton size believed requisite. As an experiment it was suggested that the top-rock layer be added and grouted, and, as shown by the illustrations, the crown and seaward slope of the fill were thus converted into a solid boulder concrete about a yard thick.

Construction was in stages, of which the grouting operation was the last. The fill was carried out part way in 1942. It was completed to full planned lengths and the head structure built in 1944. The work at this time at the beginning of the Nov. 30, 1944, storm, damage by which led to the decision to grout, is shown by Fig. 2. In this storm the waves moved 6-ton stone. It was obvious that, lacking heavier cover stone, other means of stabilizing the loose rock had to be undertaken.

Developed since 1942 as a pulpwood shipping point, the small port of Forestville is on the north shore of St. Lawrence about 200 miles down stream from Quebec City. The location is isolated, the only considerable means of transportation access to it being by boat on the river. All machinery, cement, steel and construction supplies come in by boat.

The wharf is a wood-pile structure so built that it can later be converted into a solid wharf with steel sheet-pile walls. It provides two sheltered berths, entrance to which is by a short dredged channel from the open sea. Protection from shifting sand from the tidal flat at the west is provided by a sheeted timber-crib wall. Tidal range is 16 ft. on spring tides; and an 18-ft. channel is provided at all times, and 24-hr. operation is possible during the open season of navigation. Over 100,000 cords of pulpwood are being shipped to Quebec each season by a fleet of five steamers.

As is apparent from Fig. 3, the location of the wharf left is exposed to the prevailing northeast winds and to the longest fetch of open water. Protection required a breakwater to the east. Here a high point of land provided a natural base and material for a rock fill structure. A quarry was easily opened in the face of the point and the rock loaded by shovel into dump cars which ran by gravity to the dumping point on the fill.

The general design of the breakwater is shown by the sketch in Fig. 4. A stone-filled cribwork of logs, provided to carry the rock-placing equipment, is flanked by banks of quarry-run stone topped with heavy cap stone. The grouting

plan was to add and grout solid a layer of covering quarry-run stone on the exposed seaward slope from crown to sea bed for a length of 315 ft., and to such a depth as would ensure security. Similarly the crown and upper part of the harbor slope were to be grouted as storms had shown ability to top the fill and level it off. Finally a wall of grouted crushed stone was to surmount the east-side of the crown slab to reduce the chance of topping waves.

Grouting plan

The cover slab for the seaward slope required the development of a careful procedure. It was originally planned that a rock crew was to grade the slope to 1 on 2 with a thin cover of crushed stone well in advance of a grouting crew which would then seal the cover with grout to form a tight-floor. On this a 3-ft. layer of quarry-run and crushed stone was to be dumped and graded and the top grouted to form a tight-roof. Floor and roof seals were to serve as forms between which to grout the 3 ft. of quarry run rock into a solid cover slab, as shown by Fig. 4.

Operations were begun in the spring of 1945 and several attempts were made to do the work as planned. All failed. It was found that a section graded one day would be washed to the sea bottom the next day by the tide. Grouting done during the early part of the day, on a falling tide, would be washed out in the afternoon by a rising tide. It was evident that the rise and fall of the tides and the position of the operations with respect to high or low-water levels made it necessary to restrict the work done at any particular stage of the tide to definite areas on the slope.

The structure was divided into three zones: (1) Dry zone including all areas above high water or above El. +15; (2) Critical zone, including areas on the seaward slope between high tide and low spring tides, or from E. +15 to El. +1 or El. +2, and (3) submerged zone, including area between low neap tides and the sea bed, or from El. +5 or El. +7 to El. −15. The lower critical and the upper submerged zones overlapped to provide the requisite conditions for joining the two during neap tides.

Experience had shown that the prevailing winds started about 10 to 11 a.m. causing strong wave action, and stopped at 5 or 6 p.m. followed by a calm sea during the night. Hence, rockplacing and sealing in the critical zone on the "heels" of a falling spring tide in the afternoon afforded an opportunity of sealing the slope in the "dry" to the lowest possible elevation. The same combination provided the most favorable conditions for the undisturbed setting of the grout. It can be seen that the grout at the lower level, which was placed last, was not exposed to wave action since the sea was calm at low tide during the mornings and evenings.

FIG. 2. ROCK FILL as originally completed at the start of the storm of December, 1944. Damage from this storm resulted in the decision to sheath the breakwater with concrete.

Graph shows working time

Based on the results of the first attempts, a graph was drawn showing the rise and fall of the tides against hours of the day for the balance of the season. This indicated the total time available for each phase of the work and permitted a schedule of progress to be worked out which was adhered to until the completion of the job.

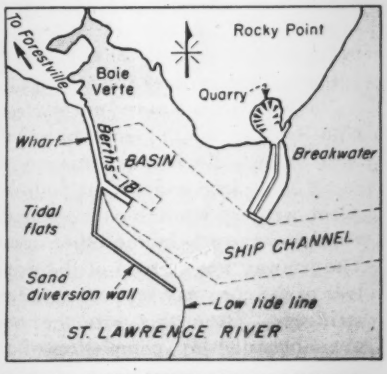


FIG. 3. FORESTVILLE HARBOR has a storm exposure to the east which is reduced by the breakwater.

Accordingly, rock placing and grading in the critical zone were started with spring high tides occurring in the early afternoon, and kept up with the receding water level, while thick grout was pumped over the graded area to form the seal. Care was taken to prevent the grout from running to lower levels by sprinkling it with rock fines and dust.

At the turn of the tide, tarpaulins weighted with I-beams, were used to cover the sealed area as the water rose. Sufficient heavy rocks were placed over the tarpaulins to increase the surface contact thereby reducing the ripple action under them of the rising tide. The same procedure was followed for the upper seal, after all the quarry-run rock had been placed in position on the day previous.

Crushed rock was deposited on this immediately before sealing to fill the larger voids. The final operation consisted of filling the voids in the 3-ft. layer of rock between the seals, with grout pumped through holes drilled in the top seal. Small areas were usually grouted at a time to prevent high pressures on the seals and development of leaks at lower levels. The operation was carried out during falling and low tides to have quick access to leaks if these should develop.

Rock placing in the submerged

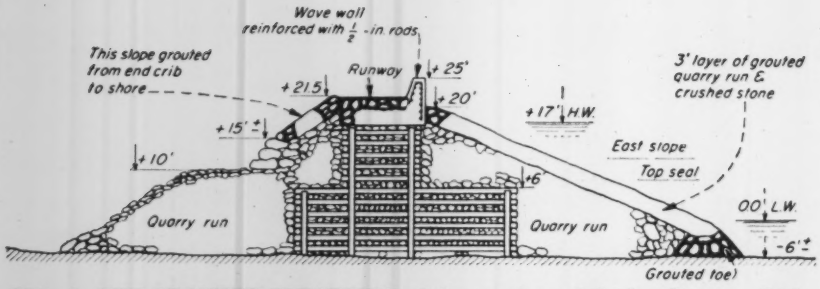


FIG. 4. THE GROUTED SHEATHING of the east face of the breakwater, which is exposed to storms in the 30-mile wide estuary of the St. Lawrence River extends to the river bottom, except at the shore end.

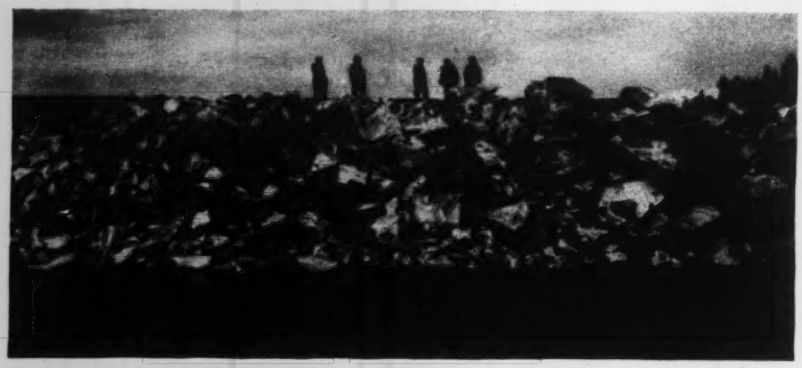


FIG. 5. LAND END of the seaward slope of rock fill (top photo). The finer stone at left indicates normal quarry-run fill, which was later capped with grouted slab. At right, the shore end of the fill that was topped with large rock. The grouting operation is shown in the lower picture.

zone at the toe of the slope was done with steel skips during low spring tides, it was completed later at low neap tides to join the lower end of the sealed critical zone. Small stone was used exclusively and easily graded to a depth of 4 ft. below water level. Large rock tended to hang up when dumped at the waters' edge and the grout ran freely through the larger voids. Following the rock work, grout was pumped through long pipes inserted 6 to 12 in. into the rock and moved at intervals when grout began to show on the submerged slope. Grouting was done during low neap tides as wave action was seldom felt at the grouted depths. A solid wall of concrete was thus formed from the sea bottom to the bottom of the critical zone.

No difficulties were encountered with work in the dry zone or on the west slope. Rock was dumped directly into place and sealing followed when weather conditions were unfavorable for work in the other zones. The runway was formed of the upper logs of the core crib supporting heavy stringers. Since this was the only available roadway, completion of the wave-wall was undertaken after the several zones were sealed and partly grouted. Consecutive 36-ft. sections of track were stripped, existing rock fill sealed with rock dust and dryer felt and new rock placed in one day. Grouting followed the next day.

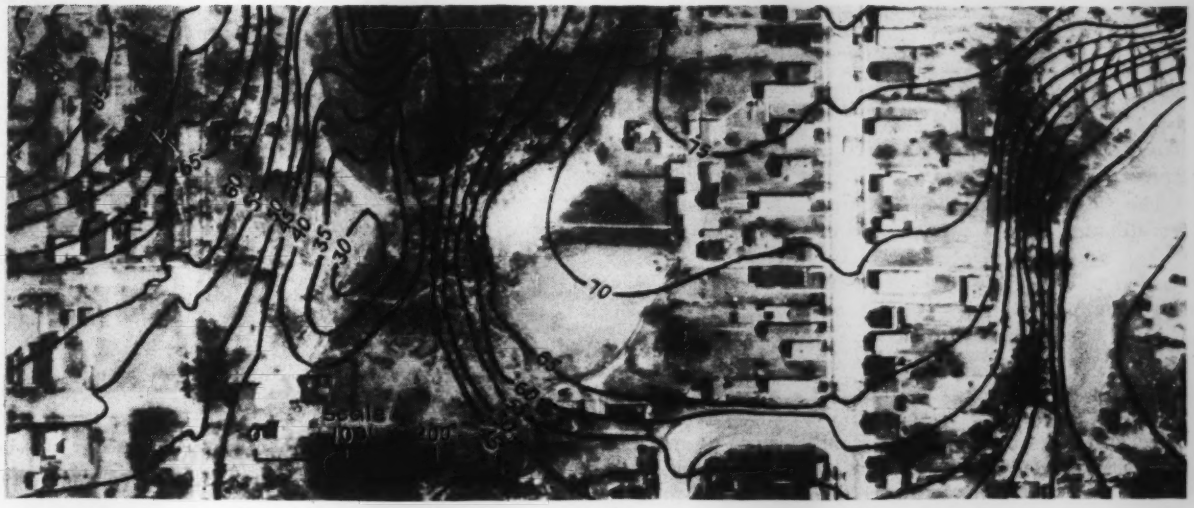
At the peak of the grouting operations the construction force was 36 men of which 14 were in the grouting crew. Four one-batch mixers were used for mixing the grout and one double 2-in. piston pump which delivered it through pipes and hose lines to inserts for injection and to nozzles for flooding the seals. One batch of grout consisted of 3 bags of cement; one 75-lb. bag of an admixture to facilitate flow of the grout and 4 cu. ft. of fine sand. The maximum distance pumped was 500 ft.

Daily output of completed work varied. It was found that 25 x 50 ft. areas could be rocked, graded and sealed in the critical zone in a 6-hr. period. Speed of grouting the 3 ft. of quarry-run rock between seals depended largely on the degree of grout-tightness of the seals. Areas of 12 x 100 ft. could be rocked and sealed in the dry zone in a 10-hr. day while the submerged zone required one low neap tide for 10 to 20 ft.

Storm tests endured

The winter of 1945-46 was a severe one, several bad storms occurring, but when the breakwater was examined in the spring of 1946, relatively minor damage was found. One large patch proved necessary, at a location which was known to have had a weak upper seal. The winter of 1946-47 proved to be even more severe. Upon detailed examination in the spring, however, the breakwater was found to be virtually in perfect condition, no patching being necessary, and the hair-cracking still so restricted as to be negligible.

Construction of the Forestville harbor works, including the breakwater, has been the responsibility of the Engineering Department of the owners, the Anglo-Canadian Pulp and Paper Mills Ltd. of Quebec city. William Harney and J. A. Carniel, contractors, assisted with the breakwater construction, the grouting work having been done by Intrusion-Prepakt Limited, of Toronto, Ont. P. A. Harakas was resident engineer for the owners, whom R. F. Legget served as special consultant. J. O'Halloran is chief engineer and W. J. Clarke vice president in charge of engineering.



Contours superimposed on aerial photographs are a step toward . . .

Faster and Cheaper Field Surveys

H. O. Sharp
and
R. K. Palmer

Professor and Assistant Professor
Geodesy and Transportation Engineering
Rensselaer Polytechnic Institute
Troy, N. Y.

FIELD EXPERIENCE has demonstrated that topographic surveys made with portable altimeters offer a practical means for converting aerial photographs into contour maps of acceptable accuracy. In addition, altimeter surveys can be made faster and with simpler equipment, and cost less than transit-stadia or plane-table methods.

The surveying altimeter, a precise and sturdy aneroid barometer, consists of a hollow corrugated-metal box, a spring-lever-chain arrangement actuating a shaft-mounted pointer, and a circular scale graduated in feet. The mechanisms are inclosed in a metal case with an observation window. Fitted with a leather case and carrying strap, the instrument is lightweight, compact, and easily read. A thermometer is included with each instrument.

On some models, the scale may be read by estimation to the nearest foot of elevation; on others, with ranges up to 15,000 ft., this accuracy cannot be attained. In reading both of the instruments shown in Fig. 2 parallax is minimized by a mirror under the pointer set in the same plane as the graduated scale.

As altimeters are affected not only by atmospheric pressure but also by temperature, thermometer readings are taken simultaneously with elevation measurements.

Altimeters produced by Wallace & Tiernan Products Inc., Belleville, N. J. and American Paulin System, Los Angeles, Calif. are shown in Fig. 2.

Three methods may be employed to obtain ground elevations with surveying altimers: (1) single-instrument observations; (2) single-base; and (3) double-base methods.

In the single-instrument method, the difference in elevation between two closely-located points can be obtained by reading a single altimeter and thermometer first at one point and then the other. The difference in readings is the "observed difference in elevation" to which must be applied a temperature correction to obtain the true difference in elevation. This method is not always accurate because by the time the second reading is taken, the measurement at the first point may have changed from what was recorded.

The single-base method gives greater accuracy. One altimeter and a thermometer at the "base" are read at five-minute intervals. A "roving" altimeter, previously compared for reading with the base instrument, is taken to the other point or points to determine the difference in elevation between these locations and the base station. Whenever the roving altimeter is read, time and temperature are recorded simultaneously.

To obtain the difference in elevations, three computations are required: Interpolation of base-instrument readings to the time of roving readings; subtraction of interpolated base and roving observations; and correction of difference in elevation for temperature variation.

Altimeter manufactures provide simple tables or nomographs for temperature correction. The table or nomograph is entered with the observed difference of elevation and the air temperature, and the total correction is quickly picked off. At 50 deg. F. there is no correction. Above 50 deg. the correction is added to the observed difference of elevation, and below 50 deg. the correction is subtracted.

When a table or nomograph is not available, the following "rule of thumb" will be found helpful and fairly accurate: The correction for each degree of temperature above or below 50 deg. F. is 0.2 ft. for each 100 ft. of observed elevation. For example, if the observed difference of elevation is 343 ft. and air temperature is 57 deg. the correction would

be $7 \times 3.43 \times 0.2 = 4.8$ ft., and the corrected difference of elevation would be 343 plus $4.8 = 348$ ft.

It should be noted that this temperature correction is necessary for the air temperature, not for the instruments themselves, which are fully temperature-compensated.

The "two-base" method, required a minimum of three altimeters, is the most accurate procedure. This method utilizes two points of known elevation called the "upper" and "lower" base and assumes that weather conditions are uniform between the two bases.

Before field work is started, the three altimeters are compared simultaneously at one base. Altimeters left at the upper and lower bases are then read every five minutes and the roving instrument is taken to each point where the elevation is desired and read. Temperature is also recorded.

Field-point elevation is computed

Since the difference in altimeter readings between the lower and upper bases will not represent the true difference in elevation between these points—because of temperature and humidity—the elevation of field points is determined from a simple proportion. This formula is:

$$\frac{El.\ F.P. - El.\ L.B.}{El.\ U.B. - El.\ L.B.} = \frac{R.F.P. - R.\ L.B.}{R.U.B. - R.\ L.B.} \qquad (1)$$

where $El.$ = elevation
R = reading
$F.P.$ = field point
$L.\ B.$ = lower base
$U.\ B.$ = upper Base

The proportion is derived from similar triangles (Fig. 3). Elevations of the upper and lower bases are plotted to scale on a vertical line (U and L) and a horizontal line is drawn through L. An arc with radius equal to the difference in altimeter readings between the upper and lower bases is swung from U to intersect the horizontal line through L at L^1. If the difference between altimeter readings at the lower base and field point is then plotted to scale along L^1U starting at L^1, point F^1 is found. A horizontal line drawn through F^1 to intersect UL determines point F. Line FL will then be the desired difference in elevation between the lower base and field point. A similar construction determines difference in elevation between the upper base and field point. As a result of the graphical solution, the analytical equation given in equation (1) may be rewritten:

$$\frac{FL}{UL} = \frac{F^1L^1}{UL^1} \qquad (2)$$

Tests to determine reliability of one make of altimeter were carried out as a part of the 1946 Rensselaer Polytechnic Institute summer survey. Upper and lower bases were about 600 ft. apart vertically and a mile horizontally. Some field points were two miles from and below the lower base; others were three miles from the upper base.

During the test, the roving altimeter was read each day on a network of field stations and the results were compared with spirit-level elevations. Air temperatures were recorded to permit computation of single-base elevations for comparison with two-base results.

Despite an unaccountable average error of 6.0 ft. on one day, the average and maximum errors on other days were about 2.0 and 3.0 ft., respectively.

As a result of altimeter-survey experience, tentative conclusions, quali-

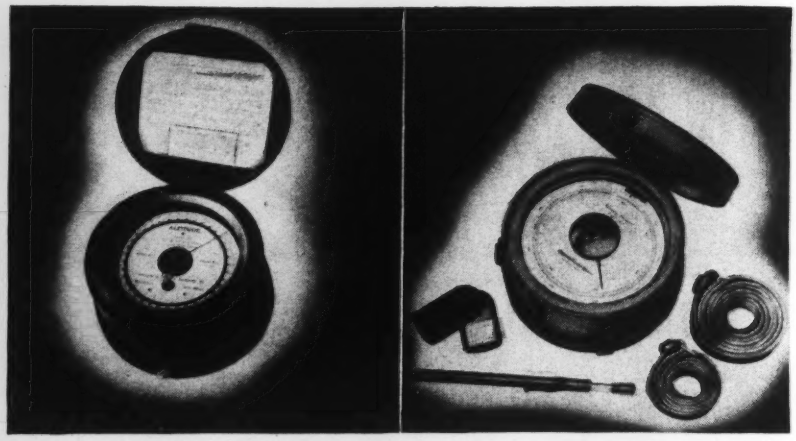


FIG. 2. TWO TYPES of portable altimeters that are available for making contour surveys.

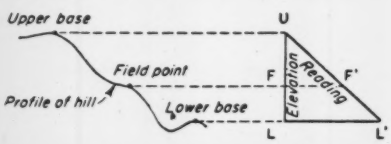


FIG. 3. IN the two-base method, the elevation of the field point is found from a proportion based on similar triangles.

ALTIMETER COMPUTATION SHEET FOR TWO BASES

U.B. Sta. Hackensack El. 1351.5
L.B. Sta. BM10 El. 710.3
K = Diff of El. = 641.2
Date July 4, 1947

Field Sta.	Key to Computation	46/K	46/6		
Time		10 22	10 31		
Reading F.S.	1	1835.2	1745.6		
Reading L.B.	2	1760 0	1760.0		
F.S. — L.B.	3 = 1 − 2	75.2	-14.4		
Reading U.B.	4	2373.5	2374.0		
Reading L.B.	5	1760.0	1760.0		
U.B. — L.B	6 = 4 − 5	613 5	614.0		
Quotient X K	7 = $\frac{3}{6}$ X K	78 6	-15.0		
El L B.	8	710.3	710.3		
El F S.	9 = 7 + 8	788.9	695.3		

FIG. 4. A SHORT FORM speeds up computation of field-point elevations.

fied by incompleteness of data, were:
1. Instrument response was at least as rapid as claimed by the manufacturer who, if anything, was conservative in recommending five field-station readings. A negligible pointer-lag was noted.
2. While results on most fair-weather days were good, some poor results were experienced. It would not, therefore, be wise to rely on elevations determined by a single visit to an important field station. In most cases, two visits would provide a sufficient check; in the few remaining instances, a third visit would afford the necessary verification.
3. A form of more rapid computation for the two-base method is desirable where many elevations are to be measured. In addition, a mechanical or graphical method seems essential to reduce readings when the altimeter is used for contouring.

Questions to be answered

Critical questions provoked by the 1946 experiences with the surveying altimeter included the following:
1. Can satisfactory results be obtained when the bases are as far apart as five miles, or if the field station is substantially above the upper or below the lower base?
2. If repeated readings were taken on a single field station during the day, would computed elevations be the same, or nearly so?
3. What are the weather limitations on the use of the surveying altimeter?
4. How would altimetry compare with other methods for determining elevations for contouring?

Answers to these questions were sought during the 1947 summer survey when altimeters were tested over a wide horizontal and vertical range. Good results were obtained with field stations five miles from either base, and the bases a mile apart. The instrument's speed in coming to rest was again clearly demonstrated. But widely varying readings on unaccountable "off days" pointed to the necssity for more than one visit to important field stations.

Reducing readings rapidly

The most valuable contribution of the second investigation was to evolve a faster procedure for computing elevations. A short form for analytical reduction as well as a mechanical device for rapid determination of elevations in the two-base method was worked out.

In the short analytical form (Fig. 4), the computation is worked out in a vertical column in steps indicated by the key. In practice, the tabular form has demonstrated its value in speed and reduction of eye fatigue.

Studies made of suggested forms of mechanical devices for reducing altimeter readings indicated that a practical device should:
(1) not be expected to give results to the nearest foot of elevation;
(2) be capable of addition and subtraction so that only elevations and readings need be fed into the device and elevations read off directly;
(3) be reasonably portable; and
(4) be inexpensive.

A design for a mechanical device to reduce altimeter readings, called an "altirule," is shown in Fig. 5. The original altirule was improvised from a small drawing board, T-square, wooden slide rule and engineer's scale. A similar device may be built by following the instructions given in the illustration. Commercial production of a low-priced model is expected in the near future.

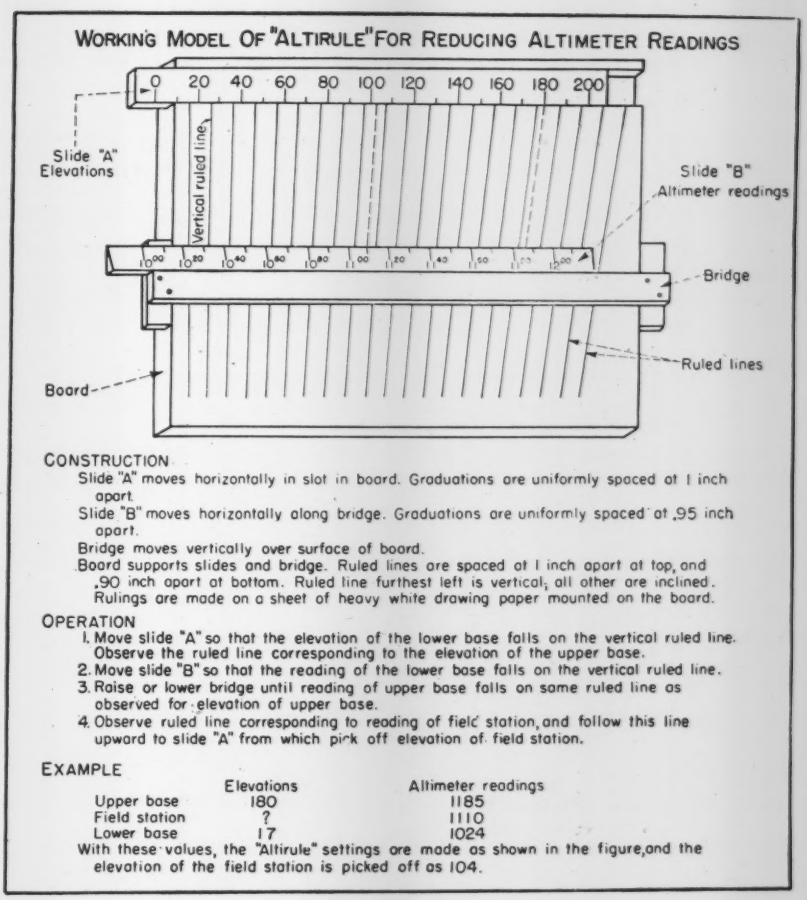

WORKING MODEL OF "ALTIRULE" FOR REDUCING ALTIMETER READINGS
0 20 40 60 80 100 120 140 160 180 200
Slide "A" Elevations
Vertical ruled line
Slide "B" Altimeter readings
Bridge
Ruled lines
Board
CONSTRUCTION
Slide "A" moves horizontally in slot in board. Graduations are uniformly spaced at 1 inch apart.
Slide "B" moves horizontally along bridge. Graduations are uniformly spaced at .95 inch apart.
Bridge moves vertically over surface of board.
Board supports slides and bridge. Ruled lines are spaced at 1 inch apart at top, and .90 inch apart at bottom. Ruled line furthest left is vertical; all other are inclined. Rulings are made on a sheet of heavy white drawing paper mounted on the board.
OPERATION
1. Move slide "A" so that the elevation of the lower base falls on the vertical ruled line. Observe the ruled line corresponding to the elevation of the upper base.
2. Move slide "B" so that the reading of the lower base falls on the vertical ruled line.
3. Raise or lower bridge until reading of upper base falls on same ruled line as observed for elevation of upper base.
4. Observe ruled line corresponding to reading of field station, and follow this line upward to slide "A" from which pick off elevation of field station.
EXAMPLE
Elevations
Altimeter readings
Upper base 180 1185
Field station ? 1110
Lower base 17 1024
With these values, the "Altirule" settings are made as shown in the figure, and the elevation of the field station is picked off as 104.

FIG. 5. AN "ALTIRULE" minimizes the tedious work of reducing a great number of altimeter readings.

Commercial availability and ease of operation of the altirule will undoubtedly lead to the application of altimeters to the undeveloped field of contouring. For example, aerial photographs of irregular terrain (rectified for tilt and made into mosaics) can be converted into acceptable topographic maps with a minimum of horizontal control (for establishing scale) and a few strategically placed bench marks for altimeter bases. It is necessary, however, that the character of the topography permit the altimetrist to identify the location of readings on the photograph.

Contours put on aerial photographs

The practicability of contouring aerial photographs by altimetry with

a two-man party was investigated last summer by two graduate students, L. W. Graves and C. F. Nicholson. After selecting an area near Rensselaer, N. Y., they obtained copies of vertical aerial photographs taken for the city. By spirit leveling, a few bench marks in the photographed area were established.

Using the single-base method, one man stayed at a bench mark with an altimeter, thermometer and watch while the other roved over the area with another altimeter, thermometer and watch and the aerial photograph. The roving altimetrist walked to field stations, recorded altimeter and temperature readings, assigned a number of each station, identified and marked the station number at the correct location on the photograph.

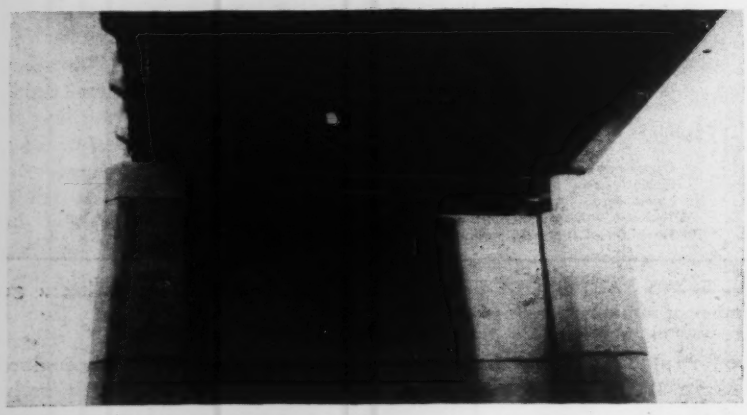
In the office, the net difference in altimeter readings between field stations and the base were corrected for temperature to give the difference in elevation. The elevations of each station was then written on the photograph and the contours were interpolated by use of conventional methods.

The photograph used in this test was furnished by Fairchild Aerial Surveys. The 9x9-in. originals from which enlargements were made to a scale of 1 in. = 200 ft. provided a photograph about 26 in. square. This sheet was used in the field to identify points and record elevations.

A part of the contoured photograph, Fig. 1, shows rugged terrain, wooded area and a populated section. A five-foot contour interval was used and field tests indicate that standard specifications (accuracy to within half the contour interval) were satisfied with a considerable saving in man-hours.

Based on man-hours, this method cost considerably less than comparable transit-stadia or plane-table surveys. Use of the two-base method requiring a third man would have provided an additional saving in man-hour because of simpler office calculations. Further savings are expected to accrue as survey techniques are perfected.

FIELD AND OFFICE



CONCRETE SHIELDS to inclose truss-bearing shoes on piers and abutments improve the overall appearance of this bridge over the Pee Dee River.

Appearance of Bridges Improved by S. Carolina

In attempting to improve the appearance of its long-span bridges, the South Carolina State Highway Department when constructing a new crossing is building a lightly reinforced shield around the shoes of the girders or trusses, as shown by the accompanying photograph. The department believes that without the shields the superstructure of the bridge to the layman appears to be resting on inadequate support, in view of the relatively small size of the shoes compared to that of the superstructure. To eliminate this condition the shields, which cost little compared to the total cost of the structure, are used.

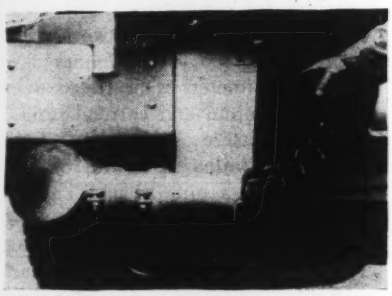
W. J. Gooding, bridge engineer for the department, is responsible for the new plan. The picture shows details of a continuous plate-girder bridge recently completed across the Pee Dee River on State Route 34.

Wood and Concrete Piles Support Oil Tanks

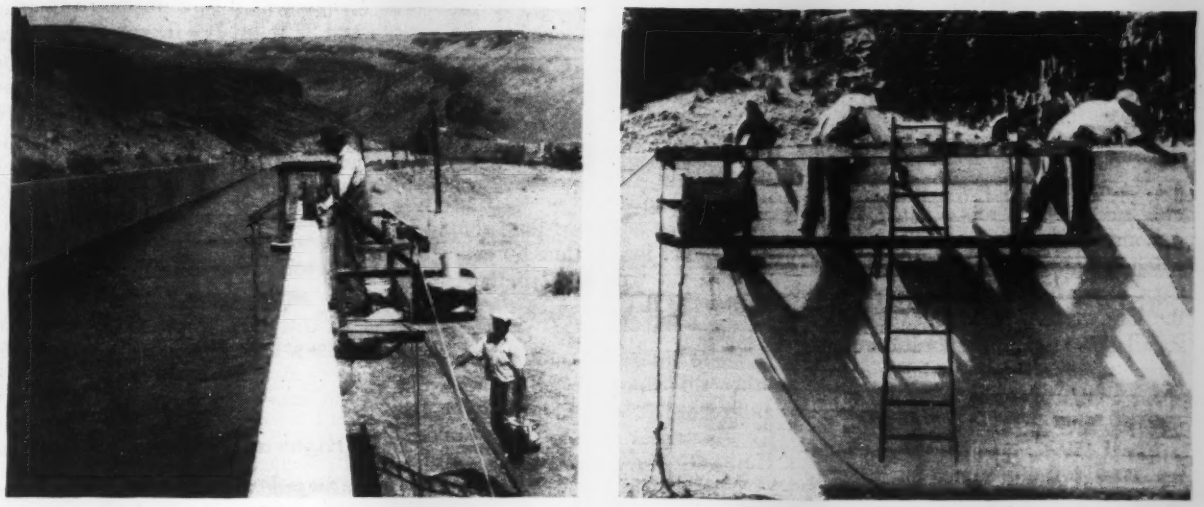
Cast-in-place composite piles and telescoping struts for positioning hanging leads were used recently in the construction of oil tank foundations at South Portland, Maine.

Timber piles 40 to 50 ft. long were driven and then shaped for a 2-ft. lap by 15-in. corrugated metal pipe. Twelve-foot lengths of the pipe, which was bituminous-coated, were slipped onto the shaped pile heads and spiked in place. A spruce log mandrel was used to drive each assembly to grade; the mandrel was withdrawn, steel rods were placed, and each shell was filled with concrete.

To minimize the danger of rupture of the lap joint through eccentric driving, the position of pile-driver hanging leads was controlled by two adjustable pipe struts between the lower end of the leads and the body of the crane. Each strut was made of two lengths of iron pipe, one 2 in. dia. and the other 2½-in. dia., which telescoped upon each other. The pipes had transverse holes drilled at 6-in. spacing. Pins were inserted in lined-up holes to fix the required strut length.—JOHN P. WALSH, *13 Ponkapoag Way, Canton, Mass.*



NOISE KILLER—Exhaust expansion chamber on exhaust pipe of diesel-powered trucks, which reduces engine noise by slowing exhaust impulses, has been developed by Julius Gaussoin, Portland, Ore., chairman of the equipment and maintenance committee, American Trucking Association. The 8- x 30-in. chamber is inserted in exhaust pipe between engine and muffler.



CUTTING PAINTING COSTS—In painting the top of the walls of a long reinforced-concrete flume, operated by the Bureau of Reclamation, much time and money was saved by use of a special mobile scaffold.

By use of a mobile scaffold shown in the accompanying photographs, the work of painting the wall-tops of a long flume on the Bureau of Reclamation's Yakima project was greatly simplified. Two floor planks and a plank along the back of the scaffold are bolted to angle irons to which pneumatic-tired wheels are attached. This arrangement permits easy assembly and dismantling of scaffold.

The tops of the walls were given four coats of a linseed-oil protective compound to prevent penetration of moisture. By means of the scaffold, which was moved along by pulling on a rope secured ahead, two painters were able to treat from 1,050 to 1,500 sq. ft. per day.

Designed by E. C. Keeler, office engineer for the Roza Division of the Yakima Project, the scaffold cost about $50. It was built in the bureau's shops.

Bureau of Reclamation Photo

LONG-DISTANCE SURVEYING—Surveying crews on the Bureau of Reclamation's Bear River project in Utah have saved time by using walkie-talkies to provide continuous contact between the instrumentman and the rodman. Although the rodman may stand in a noisy stream at some distance from the other men and although he may be unable to see the instrumentman, the members of the party have no difficulty following instructions.

READER COMMENT

China's Transportation

Sir: The article in your issue of Aug. 5 on the railway situation in China was, within its limits, remarkably good.

Some 30 years ago a study of this whole situation, with extensive surveys, was made under my direction by the late Geo. A. Kyle and the American International Corporation. Some three to five million dollars were spent at that time in developing this information.

The United States is today spending a great deal of money on friendly gestures in foreign lands. There is, however, nothing we could do that might help us and the world so much as the rehabilitation of the railways of China and their co-ordination into a unified system.

There should be added an extension of another line to Szechuen.

FRED LAVIS
Consulting Engineer
New York

Land Surveying Practice

Sir: I have read with interest the timely and informative article by Mr. Frank C. Bond on land surveying which appeared in the Sept. 2, 1948 number of your magazine (p. 69); however, I do not think this article reaches the heart of the matter.

Briefly, the purpose of a title survey is first to ascertain the exact and designed location of the title lines and then to mark and record those lines in a permanent and unmistakable manner.

Progress in title procedure and survey practice in the older states has been hobbled by strong and deeply intrenched vested interests. Normal transfer of title involves examination by a title company or private attorney and survey by a private surveyor; all this work and expense being repeated with each transfer of the same piece of property.

Lawyers disagree; surveyors' lines fail to coincide; responsibility is limited, and even the most stoutly planted monuments are destroyed with amazing rapidity.

The way out of all this chaos is not better lawyers or better and licensed surveyors, although the need for the latter is granted, but rigid state control. Titles should be recorded in the land office, guaranteed and brought up to date at each transfer by the state or county land office. Basic title lines, street, and road lines should be established for all time by competent state survey parties of similar calibre to those of the U. S. Coast & Geodetic Survey.

These lines so established and all other title lines should be described and recorded in Lambert or Mercator Cordinates as recommended by the U.S.C.&G. Survey for that state.

With such a system of survey procedure and so long as a title description be on record, even if all boundary markers be lost; the original lines could be retraced. There could be, of course, errors in the original or resurvey, but surveys tied into a state coordinate system, which is in turn tied into the U.S.C.&G. system of geodetic coordinates, are easily checked.

It is somewhat disturbing to our evaluation of human intelligence to note that, although Lambert brought out his system of map projection about the time of our War of Independence, it is just presently beginning to get a toe hold among even the more progressive of our land surveyors.

STANLEY J. REYNOLDS
Annapolis, Md.

Articulated Bridge Spans

Sir: The article "Truss-and-Beam Bridge Spans Yazoo River" (*ENR*, Aug. 19, 1948 p. 84) describes a very interesting structure. The "articulated" design used in the 1,560 ft. of rolled beam and plate girder approach spans can, however, hardly be called an innovation. The "innovations" of articulated design and the use of 18 in. width curbs for emergency walkways were both incorporated in the design of the Mississippi River Bridge at Greenville, Mississippi, opened to traffic in October, 1940.

The Greenville Bridge comprising 9,957 ft. of open structure include seventy-seven articulated spans varying from 53.5 ft. to 180 ft. The cantilever portion, in general, extends a distance of 8 ft. 2 in. on 75 ft. span and 27 ft. on 180 ft. spans. Four lines of girders were used in the shorter spans and two girders with floor beams and stringers on the 180 ft. spans. The bridge roadway is 24 ft. with two 18 in. emergency walkways.

An additional advantage to those listed for the Yazoo River Bridge is that water and dirt passing through the roadway expansion joints will fall free of the supporting piers.

R. N. BERGENDOFF
Howard, Needles, Tammen & Bergendoff
Consulting Engineers
Kansas City, Mo.

Highway Interchange Design

Sir: I wish to congratulate both you and A. M. Nash for the very excellent article "Movements Through Interchanges Simplified by Better Designs" in the July 8 issue of *Engineering News-Record*.

The point that the design of an interchange should be compatible with the requirements of the signing is extremely important and has been one of the chief reasons why many geometric designs have been faulty.

It is hoped that more highway engineers will allow their designs to include or to compensate for the limitations of both the vehicle and the driver as that is the only permanent way that I know of which will reduce the motor vehicle accident toll.

HERBERT J. KLAR
Lynbrook, N. Y.

Misleading Terminology

Sir: The unique design employing our "Jetcrete" equipment in the construction of the new aviation building at the Texas State Fair Grounds in Dallas was our pride and joy. You can imagine how we felt when we read the article appearing on page 15 of the September 9 issue of your publication regarding this project wherein you gave credit to the "Gunite" instead of to our process!

G. A. LOVEALL, President
Construction Machinery Sales Co.
Waterloo, Iowa

EDITOR'S NOTE: The word "gunite" in the article was used in the widely-accepted sense of air-applied mortar generally, and did not mean that the Gunite process had been employed. "Shotcrete", a coined word used in some specifications, would have been a better choice.

UNIT PRICES BID BY CONTRACTORS

Garage, East N. Y. Bus Depot, Brooklyn, N. Y.

OWNER: The Board of Transportation of the City of New York, James H. Griffin, chief engineer.

PROJECT: Construction of garage, repair shop and storehouse for the East New York Bus Depot in Brooklyn, N. Y. The project will include alterations to a portion of a subsurface railroad, relocation of D. C. power feeders, changing of sewer connections, restoration of sidewalks, streets and curbs.

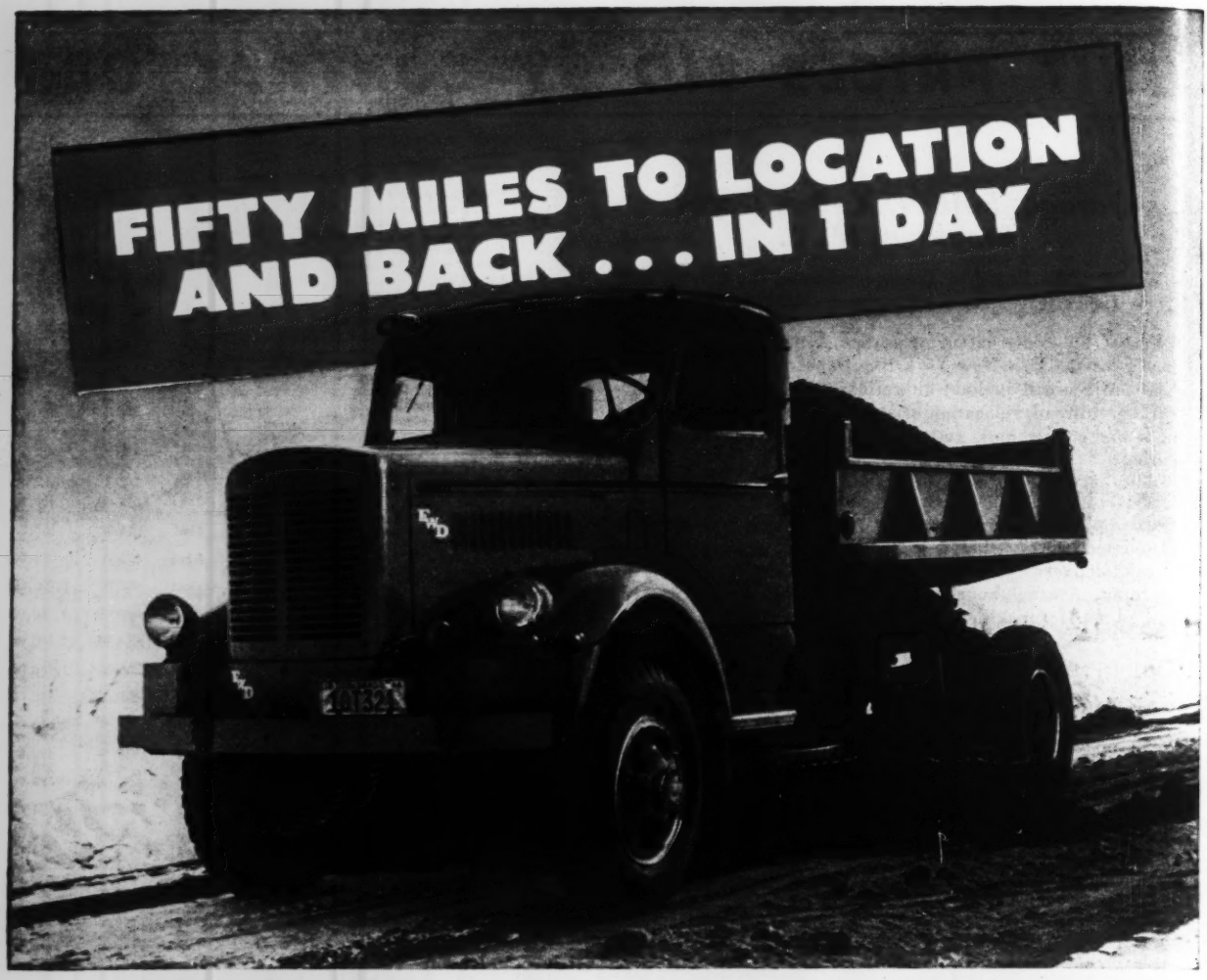
CONDITIONS: The contractor shall furnish all labor, materials, plant, power, light, heat, water, tools, and supplies. Stipulated contract time is 15 months, work to start within 20 days of delivery of contract. Access to job site is available by highway. Average hourly wage rates in New York City are: skilled, $2.91; unskilled, $1.70.

LIST OF BIDDERS: *Contract awarded May 1948

1. *Psaty & Fuhrman Inc. and Atlas Tile and Marble Works, Inc., N.Y.C. ... $5,444,352.75
2. Cauldwell-Wingate Co., Inc., N.Y.C. ... 6,364,998.00

	Item	Quantity	Unit Prices (1)*	(2)
1(a)	Excavation—other than sewers in streets	44,000 cy	7.50	9.00
(b)	Excavation—sewers & duct lines in streets	2,100 cy	7.10	40.00
18	Earth fill	700 cy	1.15	3.00
20	Stone concrete masonry	16,300 cy	36.25	60.00
22	Finished surfaces of concrete	111,000 sf	.25	.15
30	Removal of old masonry	130 cy	55.00	50.00
40	Riveted steel, beams & shapes	5,300 ton	228.00	230.00
42	Architectural steel & iron	80 ton	470.00	600.00
45	Reinforcement bars	550 ton	245.00	260.00
50	Iron castings	15 ton	225.00	500.00
55(a)	Wire mesh beam wrapping	41,500 lb	.75	1.00
(b)	Wire mesh—less than 0.1–" per ft. width of slab	550,000 sf	.09	.10
(c)	Wire mesh—more than 0.1–" per ft. width of slab	17,000 sf	.12	.12
59-A	Dowell caps	1,800 ea	.75	1.00
74	Steel shell casings	120 lf	11.50	100.00
82	Vitrified clay ducts	2,650 df	2.00	2.00
96	Broken stone for radiant heating	450 cy	7.00	6.00
100(l)	12" vitrified pipe sewers & basin connections	150 lf	7.00	5.00
(x)	24" vitrified pipe sewers & basin connections	1,000 lf	14.00	20.00
101	C. I. sewer pipe (straight)	12 ton	200.00	300.00
102	C. I. sewer pipe (special castings)	2 ton	250.00	400.00
108	Vitrified brick lining for manholes	25 sy	12.00	20.00
115(a)	Type "E" steel gratings	1,200 sf	5.60	8.00
131	Pipe stanchions	12 ea	45.00	80.00
135	Cement sidewalks	900 sy	4.50	7.00
151	Support, maintenance & protection of railroad, etc.	lump sum	65,650.00	150,000.00
160(h)	For laying 8" C. I. low pressure water pipe & appurtenances	15 lf	20.00	20.00
166	C. I. hub & spigot straight pipe	70 ton	420.00	200.00
167	C. I. hub & spigot pipe, special castings	5 ton	925.00	400.00
174(h)	8" C. I. or steel gas pipe & appurtenances	30 lf	20.00	20.00
(l)	12" C. I. or steel gas pipe & appurtenances	15 lf	26.00	25.00
(t)	20" C. I. or steel gas pipe & appurtenances	900 lf	40.00	40.00
227	Maintaining, protecting, securing, underpinning bldgs	lump sum	52,000.00	150,000.00
230	Removing & disposing of bldgs. & structures	lump sum	83,000.00	180,000.00
290-A	Constructing, maintaining & removing temp. enclosures, etc.	lump sum	25,000.00	15,000.00
290-C	Removing & disposing of temp. bridge & installing steel sash	lump sum	18,000.00	500.00
290-D	Constructing, removing & disposing of temp. partitions	lump sum	35,000.00	12,500.00
291(a)	Installing new cables	lump sum	13,000.00	4,000.00
(b)	Relocating feeder panel	lump sum	33,100.00	4,500.00
501-C	White glazed tile	14,300 sf	2.10	3.20
501-D	Colored glazed tile	9,700 sf	2.10	3.20
510(b)	Mineral acoustical tile	1,600 sf	.75	2.00
511-C(a)	Quarry tile for floors	18,000 sf	1.40	2.40
(b)	Quarry tile for bases	2,600 sf	5.00	6.00
517-D	Enameled brick	6,000 sf	2.25	3.00
519	Marble wainscot	600 sf	5.25	8.50
522-G(a)	Plastering on concrete	12,000 sy	2.00	3.00
(b)	Plastering on metal lath	400 sy	2.50	3.50
(c)	Plastering sewer manholes	100 sy	2.50	3.00
523(a)	Cement work, wainscots or bases	3,000 sf	1.50	1.00
(d)	Cement work, finish on concrete	100 sf	.30	.30
(f)	Cement work, 1" floor finish	375,000 sf	.27	.30
525	Cinder fill	900 cy	5.00	7.00
525-A(a)	Cinder concrete masonry	5,800 cy	45.60	60.00
(b)	Cinder concrete fill	590 cy	15.00	20.00
526(a)	Concrete self-supporting stairs	1,360 lf tr	15.50	6.00
(f)	Non-slip metal treads	780 sf	4.35	10.00
526-C	Non-slip tile treads	30 sf	8.50	4.00
527(c)	Common brick for other than ext. walls, except for sewer manholes	56,000 cf	2.68	3.50
(cc)	Common brick for other than ext. walls, for sewer manholes	600 cf	2.75	3.50
528-E(b)	Terra-cotta coping, 12" walls	2,800 lf	1.25	2.00
528-H	Hollow tile masonry	9,500 cf	1.75	2.50
528-CB(a)	Cinder block masonry	45,000 cf	1.68	2.50
(b)	Gypsum block masonry	5,250 cf	2.50	2.50
529 (b)	Expanded metal lath	400 sy	2.75	2.50
532-A(a)	Type "A" metal toilet compts., type "Aa" (single)	4 ea	315.00	400.00
(b)	Type "A" metal toilet compts., type "Ab" (2 in battery)	6 bat	616.00	550.00
(c)	Type "A" metal toilet compts., type "Ac" (3 in battery)	5 bat	925.00	800.00
(d)	Type "A" metal toilet compts., type "Ad" (4 in battery)	1 bat	935.00	1,100.00
(e)	Type "A" metal toilet compts., type "Ae" (5 in battery)	2 bat	1,040.00	1,250.00
(f)	Type "A" metal toilet compts., type "Af" (6 in battery)	2 bat	1,350.00	1,500.00
532-B(g)	Type "B" metal toilet compts., type "Bg" (7 in battery)	1 bat	1,560.00	1,700.00
532-C(c)	Type "C" metal toilet compts., type "Cc" (3 in battery)	1 bat	525.00	850.00
(j)	Type "C" metal toilet compts., type "Cj" (9 in battery)	1 bat	1,775.00	2,500.00
532-H(a)	Metal cubicles with doors	4 ea	950.00	900.00
(b)	Metal cubicles without doors	4 ea	850.00	400.00
532-S	Metal toilet screens, in place	2 ea	90.00	250.00
533-A(b)	Windows, stainless steel, fixed sash	50 sf	26.00	80.00
533-G(a)	Windows, steel, fixed sash, with vent. panels	17,500 sf	1.65	1.60
(d)	Windows, steel, special sash, as required in section 576	160 sf	2.70	2.00
534-B(dd)	Coat hooks	30 ea	1.50	1.00
535-H(c)	Hollow metal doors, type "CH"	9 pr	807.00	600.00
(d)	Hollow metal doors, type "DH"	32 ea	601.00	370.00
(e)	Hollow metal doors, type "FH"	24 ea	150.00	260.00
(f)	Hollow metal doors, type "FH"	8 pr	795.00	570.00
(m)	Hollow metal doors, type "MH"	32 ea	446.00	300.00
(p)	Hollow metal doors, type "PH"	5 ea	150.00	150.00
535-K(c)	Kalamein doors, type "C"	6 pr	528.00	285.00
(d)	Kalamein doors, type "D"	25 ea	150.00	190.00
(da)	Kalamein doors, type "DA"	1 ea	224.00	140.00
(e)	Kalamein doors, type "F"	47 ea	326.00	190.00
(f)	Kalamein doors, type "F"	9 pr	645.00	350.00
(m)	Kalamein doors, type "M"	27 ea	445.00	180.00
(p)	Kalamein doors, type "P"	7 ea	100.00	85.00
535-S(rm)	Steel doors, type "RSM," motor-operated doors	3 ea	3,795.00	2,500.00
(ru)	Steel doors, type "RSU," underwriters doors	4 ea	2,240.00	1,400.00
535-U(e)	Fire doors, type "EU"	4 ea	402.00	220.00
(f)	Fire doors, type "FU"	4 pr	392.00	400.00
(h)	Fire doors, type "HU"	8 ea	610.00	520.00
535-W(gm)	Wood doors, type "QM"	10 ea	3,830.00	2,500.00
535-X(a)	Special entrance doors, stairway "A"	lump sum	7,215.00	4,000.00
(b)	Special entrance doors, stairway "B"	lump sum	8,260.00	6,000.00
(c)	Special entrance doors, stairway "D"	lump sum	10,180.00	10,500.00
(d)	Special entrance doors, timekeeper's office	lump sum	3,690.00	3,000.00
(e)	Special entrance doors, entrance on Bushwick Ave	lump sum	19,190.00	20,000.00
536(g)	Pipe railing, other than for stairs	400 lf	7.55	10.00
(gg)	Pipe railing for stairways	280 lf	7.15	10.00
536-A	Architectural stair railings	270 lf	15.75	25.00
536-X(d)	Wire mesh partitions	125 lf	14.80	20.00
538	Grilles for vent ducts	340 sf	2.20	7.00
543-H(a)	Cast iron saddles for doors	140 lf	10.65	15.00
(b)	Ribbed steel saddles for doors	15 lf	5.15	8.00
543-K(n)	Steel stairways (other than pressed steel)	75 lf tr	14.20	20.00
(o)	Steel intermediate stairway landing	70 sf	5.10	8.00
544(f)	Galvanized steel pipe handrails	550 lf	3.00	4.00
(ff)	Aluminum pipe hand-rails	310 lf	8.50	12.00
552-A(g)	Aluminum grilles with louvers	6 gr	20.00	40.00
(h)	Aluminum grilles, without louvers	115 gr	10.00	20.00
611	Cut-stone work	lump sum	66,775.00	150,000.00
615	Cast-iron scuppers	75 ea	10.00	30.00
616	Wire mesh guards for windows	6,530 sf	1.40	2.00
618	Flag pole, complete	lump sum	210.00	1,500.00
619	Window frame and shelf	lump sum	80.00	200.00
621(a)	Sheet copper, formed as indicated	8,000 sf	.95	1.10
(c)	Copper leader heads	17 ea	12.00	25.00
(g)	Copper leader inlets	34 ea	4.00	15.00
(i)	3" Copper leaders	90 lf	1.00	1.00
(j)	4" Copper leaders	180 lf	1.25	1.10
622	Copper Covered Scuttle	1 ea	145.00	150.00
623	Suspended aluminum ceilings	8,500 sf	1.25	1.50
627	Timber ramps	lump sum	2,100.00	5,000.00
628	Creosoted wood block floor	40,000 sf	3.81	.45

Continued on page 85



. . . and still does a day's work maintaining roads

Every day FWD owners report more miles per day—greater speed from garage to job and from job to job with the FWD Maintainer. Reports of 50 miles or more to location and back — in one day — are not unusual.

With FWDs, long distance hauls are more than a fair-weather proposition. During spring, summer, and fall, you can go far afield to build and grade roads . . . to haul material and equipment. What's more FWD's four driving wheels pull through mud—get you over the roughest terrain.

And when winter comes, you can use this same four-wheel-drive power to clear snow from highways . . . at speeds up to 30 miles per hour.

To get *all* the facts on how the FWD "HG" Maintainer can provide low-cost, year-around service for you, see your nearest FWD distributor . . . or write—

THE FOUR WHEEL DRIVE AUTO CO., Clintonville, Wis. • *Canadian Factory:* Kitchener, Ontario

America's Foremost Heavy-Duty Truck

EQUIP YOUR FWDs NOW . . . FOR FAST, LOW-COST SNOW CLEARING

Garage, East N. Y. Bus Depot, Brooklyn, N. Y.

Continued from page 83

630(a)	Asphalt tile for floors	8,000 sf	.32	.33
631	Linoleum	18,000 sf	.34	.35
641(a)	Passenger elevator	lump sum	40,630.00	35,000.00
(b)	Freight elevator	lump sum	41,965.00	37,500.00
642(a)	Hydraulic hoists, style "A"	8 ea	7,870.00	5,000.00
(b)	Hydraulic hoists, style "B"	56 ea	9,180.00	6,800.00
(c)	Hydraulic hoists, style "C"	2 ea	8,100.00	5,000.00
(d)	Hydraulic hoists, style "D"	1 ea	9,520.00	7 000.00
(e)	Hydraulic hoists, style "E"	4 ea	9,212.00	6,800.00
644	Bus washers	2 ea	21,649.00	20,000.00
645	Brake tester	lump sum	3,780.00	6,000.00
647	Sump pump	lump sum	570.00	600.00
750-D(a)	Pressed steel stairs	2,570 lf tr	7.90	12.00
785(ca)	3 ply waterproofing	1,100 sy	2.05	3.00
(ep)	5 ply waterproofing	19,500 sy	1.53	2.20
(f)	1½" fibre board insulation for roofs	180,000 sf	.30	.40
(l)	Sheet lead floor surfacing	1,100 sf	1.85	3.50
(s)	Spandrel type waterproofing	20,500 sf	.30	.35
785-A	Layer of slag for roofs	19,500 sy	.63	.65
785-B	Felt flashing	7,050 lf	1.50	.60
785-W	Dampproofing of concrete masonry	400 sy	.56	1.50
801-F	Dampproofing interior surfaces of exterior walls	3,800 sf	.09	.15
527-B(a)	Exterior masonry walls, class "A" brick	68,200 sf	1.60	2.45
(c)	Exterior masonry walls, class "C" brick	11,000 cf	2.73	3.50
(f)	Cinder concrete block & masonry	50,600 cf	1.33	2.50
643-A	Pumping dispensing system	lump sum	46,422.00	60,000.00
646-A(a)	Electric chassis dynamometer (ground floor)	lump sum	31,180.00	32,000.00
(b)	Electric chassis dynamometer (second floor)	lump sum	31,180.00	31,500.00

Trunk Sewer, Maryland

OWNER: Washington Suburban Sanitary Commission, Hyattsville, Md.; Harry R. Hall, chief engineer.

PROJECT: Construction of Central Ave. and Cabin Branch trunk. sewer from Hill Rd. to Carmody Hills, Prince Georges County, Maryland. Includes extra rock excavation; installation of manhole frames, covers, and steps; and laying 400 feet of 6-inch underdrain.

CONDITIONS: The Commission to furnish standard manhole frames, covers and steps. All other materials to be furnished by the contractor. Access to the job site is available by highway. Stipulated contract time is 100 calendar days. Average hourly wage rates in Baltimore for skilled labor are $2.35, for common $1.25.

LIST OF BIDDERS: *Contract awarded July 9, 1948

1. *Intercounty Constr. Corp., Hyattsville, Md. $109,063.08
2. Nickles Bros., Hyattsville, Md. 126,933.50
3. Leo Butler Co., Silver Spring, Md. 134,740.00
4. Ligon and Ligon, Baltimore, Md. 138,229.50
5. United Foundation Corp., Union, N. J. 138,826.50

	Item	Quantity	Engineer's Estimate	Unit Prices (1)*	(2)
1	Earth excavation and refill for 30" sewer	Under 10'	50 lf	$4.50	$2.51	$5.00
2	Earth excavation and refill for 30" sewer	10'-12'	50 lf	6.00	3.07	5.00
3	Earth excavation and refill for 30" sewer	12'-14'	100 lf	7.25	3.62	6.00
4	Earth excavation and refill for 30" sewer	14'-16'	80 lf	10.00	7.79	10.00
5	Earth excavation and refill for 30" sewer	16'-18'	335 lf	12.00	8.86	16.00
6	Earth excavation and refill for 30" sewer	Over 18'	100 lf	15.00	9.89	20.00
7	Earth excavation and refill for 27" sewer	Under 10'	20 lf	4.25	2.51	5.00
8	Earth excavation and refill for 27" sewer	10'-12'	90 lf	5.50	3.07	5.00
9	Earth excavation and refill for 27" sewer	12'-14'	220 lf	7.00	3.62	6.00
10	Earth excavation and refill for 27" sewer	14'-16'	175 lf	9.00	7.79	10.00
11	Earth excavation and refill for 27" sewer	16'-18'	285 lf	11.00	8.86	16.00
12	Earth excavation and refill for 27" sewer	Over 18'	10 lf	14.00	9.89	20.00
13	Earth excavation and refill for 24" sewer	0'-6'	110 lf	3.00	1.75	5.00
14	Earth excavation and refill for 24" sewer	6'-8'	90 lf	3.50	3.23	5.00
15	Earth excavation and refill for 24" sewer	8'-10'	440 lf	4.00	3.23	5.00
16	Earth excavation and refill for 24" sewer	10'-12'	3,110 lf	5.50	4.25	5.00
17	Earth excavation and refill for 24" sewer	12'-14'	1,530 lf	6.75	4.58	6.00
18	Earth excavation and refill for 24" sewer	14'-16'	180 lf	9.00	7.73	10.00
19	Earth excav. and refill for 24" sew.	16'-+	10 lf	11.00	8.25	20.00
20	Furnishing and laying 30" RCCPX	30"	715 lf	7.50	9.16	8.00
21	Furnishing and laying 27" RCCPX	27"	800 lf	7.00	7.38	7.50
22	Furnishing and laying 24" RCCPX	24"	4,125 lf	6.50	7 17	6.00
23	Furnishing and laying 24" RCCPX	24"	1,345 lf	6.30	6.72	5.70
24	Furnishing and laying Tee and Wye branches on sewers in addition to linear ft. payment for pipe	30" x 6"	6 ea	25.00	31.94	62.00
25	Furnishing and laying Tee and Wye branches on sewers in addition to linear ft. payment for pipe	27" x 6"	2 ea	22.00	27 08	60.00
26	Furnishing and laying Tee and Wye branches on sewers in addition to linear ft. payment for pipe	24" x 6"	15 ea	20.00	28.27	60.00
27	Furnishing Watertight manhole frames and covers Caroline Foundry #129 or equal (complete assemblies)	——	6 ea	75.00	82.28	75.00
28	Building Manholes, including placing of frames, covers and steps	5' dia.	50 vf	40.00	53.29	35.00
29	Building Manholes, including placing of frames, covers and steps	4' dia.	190 vf	25.00	21.54	25.00
30	Building drop connection at manhole, 24" (C.I. pipe & fittings by the Comm.)	Type "R"	1 ea	200.00	459.75	85.00
31	Concrete for encasement cradles and abutments	Class V	100 cy	22.00	25.00	22.00
32	Furnishing material for and laying 6" underdrains	6"	4,000 lf	.85	1.05	1.10
33	Sheeting and shoring left in place by order of Engineer	——	200 MftBM	85.00	48.00	100.00
34	Rock excav. in addition to price bid for earth excav. and refill	——	— cy	12.00	12.00	12.00
35	Excav., gravel refill below subgr.	——	— cy	7.00	7.00	7.00
36	Excav., earth refill below subgr	——	— cy	4.00	4.00	4.00
37	Lumber left in the foundation by order of the Engineer	——	— MftBM	150.00	150.00	150.00
38	Misc. and test pit earth excavation and refill	0'-6'	— cy	3.50	3.50	3.50
39	Misc. and test pit earth excavation and refill	0'-10'	— cy	4.00	4.00	4.00
40	Misc. and test pit earth excavation and refill	0'-10'	— cy	5.00	5.00	5.00

Asphalt Pavement, Boston, Mass.

OWNER: The City of Boston, Massachusetts.

PROJECT: Construction of 4-inch bituminous concrete base and 3-inch sheet asphalt pavement on Goethe St., Richardson St., Richfield Park, Tobin Rd. and Wayburn Rd. in Boston, Massachusetts. Includes 5275 cy of excavation and 535 cy of rock excavation; installation of cedar post fence, stone walks, and edgestone.

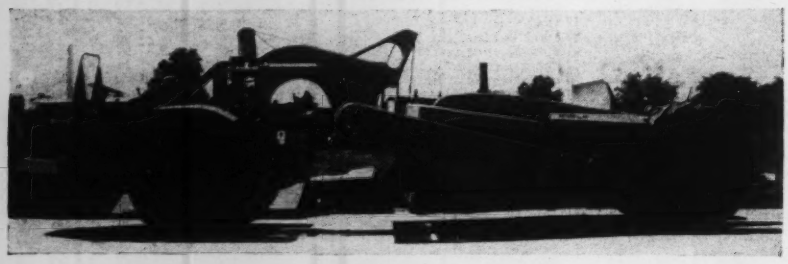
CONDITIONS: City to furnish granite blocks, all other materials to be furnished by the contractor. Stipulated completion date is December 31, 1948. Access to the job site is available by highway. Minimum wage rates for street work are: skilled, $2.175 per hour; semi-skilled, $1.80 per hour; common $1.55 per hour.

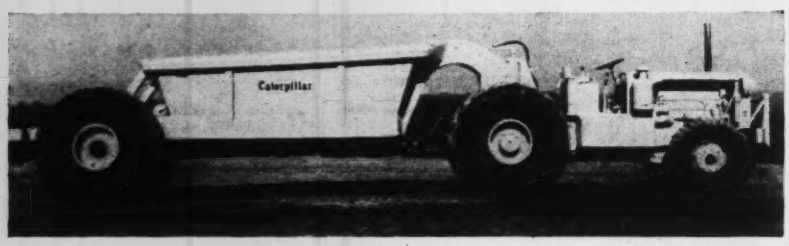
LIST OF BIDDERS: *Contract awarded June 2, 1948

1. *A. Singarella & Son, Boston, Mass. $57,729.25
2. S. J. Tomasello Corp., Boston, Mass. 61,794.75
3. Caruso & Barone, Inc., Boston, Mass. 62,716.75
4. James A. Susi, Boston, Mass. 62,720.25
5. Dooley Bros., Inc., Boston, Mass. 68,273.00

	Item	Quantity	Unit Prices (1)*	(2)	(4)
1	Trees removed	lump sum	$420.00	$1,800.00	$500.00
2a	Excavation	5,275 cy	.60	.77	1.50
2aa	Water box excavation	125 cy	1.00	1.00	1.00
2b	Rock excavation	535 cy	5.00	5.00	7.00
2c	Bank gravel	3,425 tons	1.00	1.30	1.50
2d	Crushed stone	365 tons	2.00	2.00	2.50
3a	Straight edgestone	3,805 lf	2.50	3.00	2.50
3b	Circular edgestone	455 lf	3.00	4.00	3.00
3c	Reset edgestone	130 lf	.60	.80	.60
3d	Corner edgestone	88 lf	11.00	10.50	10.00
4a	Alternate—Class B concrete	1,215 cy	11.00	11.00	11.00
4d	Extra concrete	100 cy	15.00	14.00	20.00
5d	Alternate—Bit. concrete base	1,500 tons	8.00	6.75	6.50
6a	Granite block edgings	5 sy	7.00	6.00	10.00
7b	Sheet asphalt	555 tons	8.20	11.00	8.30
7c	Asphalt binder	555 tons	7.75	9.00	7.55
9a	Art. stone walks	293 cy	27.00	20.00	30.00
9b	Art. stone fdns	100 cy	42.00	45.00	52.00
13a	Covers	65 ea	4.00	4.00	4.00
13c	Brickwork	130 courses	.75	.75	.75
14	Sign post	3 posts	10.00	10.00	5.00
17	Cedar post fence	25 lf	4.00	3.00	2.50
18	Stone bounds	14 bounds	20.00	15.00	12.00

NEW PRODUCTS

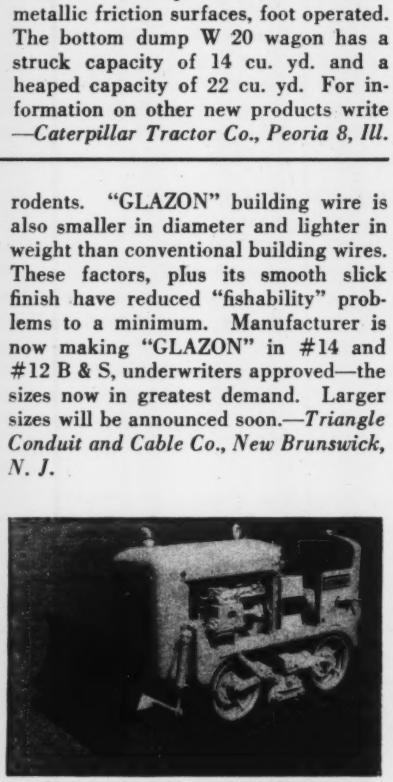




NEW CATERPILLAR EQUIPMENT—Pictured above are two of the ten additions about to be made to "Caterpillar" production. They are, upper, the diesel DW 21 wheel-type tractor equipped with the No. 21 scraper; and, lower, the diesel DW 20 wheel-type tractor equipped with the W 20 wagon. Both of these earthmoving units are powered by a new diesel engine, a 6-cylinder power plant providing 225 hp. at 2,000 rpm. governed full load speed. All working speeds are controlled through a foot throttle, while the governor controls speeds at low idle and prevents over-speeding of the engine. Each unit has the "Caterpillar" constant mesh spur and helical gear transmission, pump lubricated, and a 16-in. diameter double plate clutch with semi-metallic friction surfaces, foot operated. The bottom dump W 20 wagon has a struck capacity of 14 cu. yd. and a heaped capacity of 22 cu. yd. For information on other new products write *—Caterpillar Tractor Co., Peoria 8, Ill.*

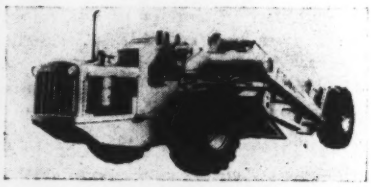
RUST PREVENTIVE—When added to petroleum products at the rate of 2½ gallons per 40,000 gal., RD-119 eliminates rust and scale on steel, zinc, aluminum and brass surfaces contacted by the petroleum product. While this admixture's primary benefits will accrue to the oil industry's tanks, tank cars and trucks, tankers and pipelines, important reductions will be effected in the cost of maintaining internal combustion and petroleum heating equipment. RD-119 provides a polymolecular protective layer that prevents the metal surfaces from coming in contact with air and moisture.—*Sinclair Refining Co. 630 Fifth Ave., New York, N. Y.*

BUILDING WIRE—A new and improved type of rubber covered braided building wire (R, RH and RW) has just been announced. Known as "GLAZON," it is covered with a sheath woven of inert, inorganic fibres of high dielectric strength, finer than a hair. These fibres, and the finished sheath are flexible, much stronger than cotton or rayon, cannot burn, are unaffected by moisture or temperature changes, cannot rot, are immune to all ordinary acids and alkalis and repellent to fungus and rodents. "GLAZON" building wire is also smaller in diameter and lighter in weight than conventional building wires. These factors, plus its smooth slick finish have reduced "fishability" problems to a minimum. Manufacturer is now making "GLAZON" in #14 and #12 B & S, underwriters approved—the sizes now in greatest demand. Larger sizes will be announced soon.—*Triangle Conduit and Cable Co., New Brunswick, N. J.*



HYDRAULIC BACKFILL BLADE—Recent addition to Schramm Model 60 crawler type compressor is hydraulically operated backfill blade operated by pressure supplied by hydraulic pump. Two hydraulically operated cylinders mounted on track guards produce blade travel of 14 in. above ground and 11 in. below ground level. Designed for use in backfilling ditches in conjunction with a pneumatic backfill tamper, and for general light grading.—*Schramm, Inc., West Chester, Pa.*

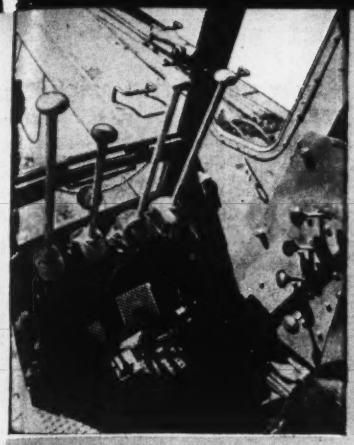
ALUMINUM NAILS—For the building industry aluminum nails are being made in six types and sixteen different sizes. These include common nails, roofing nails, special roofing nails, barbed, shingle nails, plaster-board nails and felt paper nails. The common nails include the following sizes: 4, 6, 8, 10 and 16 d. The roofing nails, all with 7/16 in. heads come in lengths from ⅞ to 2½ in. The special roofing nail is supplied with a barbed 1¾-in. shank with a 7/16-in. head. In addition to being highly resistant to corrosion and stain, aluminum nails weigh only 1/3 as much as steel nails, so that the buyer gets three times as many nails per pound. When used with wood siding there is claimed to be no danger of rusting of nail heads with subsequent discoloration of paint.—*Reynolds Metals Co., 2500 S. Third St., Louisville, Ky.*



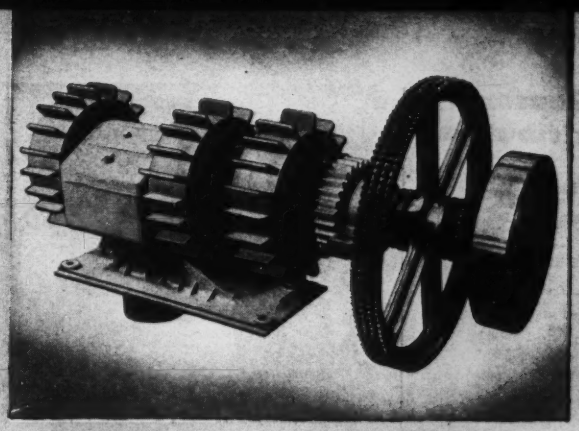
ELECTRIC-CONTROL TOURNAPULL—Matched with a 13.3-cu.yd. or 16-ton scraper, the model C Tournapull is powered by a 150-hp. 6 cylinder Diesel engine and has four forward speeds from 2.19 to 17.3 mph. Steering, scraper bowl, apron and tailgate are controlled by individual electric motors supplied by a 240-v. 120-cycle a.c. generator built in line with the engine. Constant mesh transmission allows instantaneous selection of gear ratios without shifting or loss of momentum. Other features are a torque proportioning differential, 21x 25 tapered bead tires, multiple disc air brakes, and a 130-gal. fuel tank. The model C has more than a 90 deg. turning angle and can turn around in 14 ft. 6 in. Overall specifications with scraper are length 31 ft.; height 9 ft. 3 in.; width 11 ft. 4 in.; wheelbase 18 ft. 2 in. and empty weight 29,220 lbs.—*R. G. LeTourneau Inc., Peoria, Ill.*

DRAFTING-ROOM AID—Heavy circles can be drawn with a single spin by spring-loaded drop bow compass. The spring has just enough tension to make a firm line. It is not used with the pen. —*E. L. Hemenway, Ridgefield, N. J.*

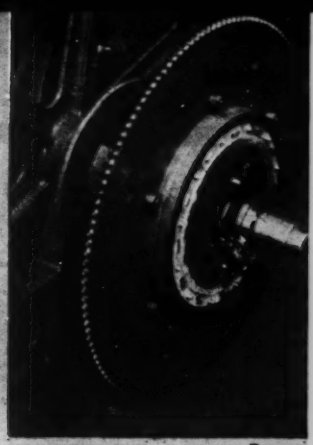
(*Continued on page* 90)



AIR CONTROL—all motions controlled by air. Simple—easy to operate—powerful.



SWING SHAFT—This swing, propel and crowd retract shaft assembly is equipped with three Fawick Airflex clutches which require no adjustment at any time. Special heat dissipating fins assure cool running clutches



INDEPENDENT BOOM HOIST standard on all machines, for high speed operation and safe lowering of boom.

THE BIGGEST LITTLE MACHINE ON CRAWLERS . . .

● Fast . . . powerful . . . a big yardage producer . . . describes the MARION 33-M shovel.

SIMPLICITY OF DESIGN—clean and compact throughout.

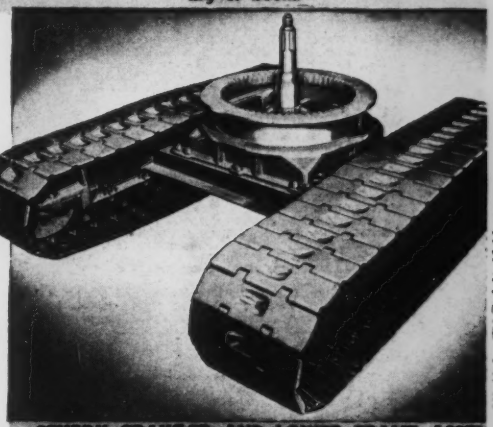
STURDY CONSTRUCTION—built for maximum strength, long life service and low maintenance.

EASE OF CONTROL—all motions, steering, propelling, braking, swing brake, dipper trip, and gear changes are AIR CONTROLLED.

EASE OF MAINTENANCE—brake adjustments, all machinery, and lubricating fittings are readily accessible. Only one adjustment for hoist and crowd out clutches. No adjustments needed for swing, propel, crowd retract or boom hoist clutches.

READILY CONVERTIBLE—from one front end to another.

These and many more desirable features make the MARION 33-M a fast, powerful, dependable and economical machine.



STURDY CRAWLER AND LOWER FRAME ASSEMBLY—self-cleaning, non-clogging crawlers assure free operation under difficult ground conditions

COMPACT, ACCESSIBLE MACHINERY easy to get at for daily routine attention. Mounted on sturdy cast-welded main frame.

From 3/4 Cu. Yd. To 1 1/2 Cu. Yd.

SEE US AT THE ROAD SHOW
Space 3023

WRITE FOR 33-M BULLETIN
It will give you *all* of the facts about the 33-M built to move yards fast at low cost. Send for it today!

MARION

POWER SHOVEL COMPANY, MARION, OHIO, U. S. A.

Offices and Warehouses in all Principal Cities • Established 1884

Worthington-Ransome Blue Brute Distributors

See ad on page 91 for list of equipment in each line

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Ala., Birmingham, Ragsdale Mach. Co., Inc.
Alaska, Anchorage, Airport Mach. & Storage Co.
Ariz., Phoenix, Lee Redman-Equipment Co.
Ark., Fort Smith, R. A. Young & Son
Little Rock, R. A. Young & Son

Calif., Richmond, Bay Equip. Co.
Calif., L. A. Golden State Equip. Co.
Colo., Denver, Power Equipment Co.
Conn., Wallingford, Wilhelm-Davies Co., Inc.

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Jacksonville, Ogden Equip. Co.
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Louisiana, Monroe, Louisiana Machy. Co., Inc.

Maine, South Portland, N. A. Burkitt, Inc.
Mich., Muskegon, Lakeshore Machy. & Supply Co.
Mich., Detroit, W. H. Anderson Co., Inc.
Minn., Minneapolis, Minneapolis Equip. Co.
Mass., Cambridge Field Machy. Co.
Mass., West Springfield, E. F. Edson Co., Inc.
Miss., Jackson, Jackson Road Equip. Co.
Md., Baltimore, Paving Supply & Equip. Co.
Md., Salisbury, Paving Supply & Equip. Co.
Mo., Clayton, The Howard Corporation
Mo., Kansas City, Machinery & Supplies Co., Inc.
Montana, Billings, Seitz Machinery Co., Inc.
Helena, Caird Eng. Works
Montana, Missoula, Miller Machinery Co.

Nevada, Elko, C. W. Paul Hardware and Machy. Co.
N. Hampshire, Manchester, R. C. Hazleton Co., Inc.
N. J., No. Bergen, American Air Comp. Corp.
N. M., Albuquerque, Industrial Supply Co.
N. M., Roswell, Smith Machy. Co.
N. Y., Buffalo, Murray Equip. Co.
New York, Hodge & Hammond, Inc.
N. Y., Syracuse, Mid-State Contr. Equip. Co., Inc.
N. Y., Troy, Capitol Equip. Co., Inc.
N. C., Statesville, Interstate Equip. Co.
N. D., Fargo, Smith, Inc.

Ohio, Cincinnati, Carroll-Edwards & Co.
Dayton, Carroll-Edwards & Co.
Toledo, The Kilcorse Machy. Co.
Okla., Oklahoma City, Tattan-Douglas Equip. Co.
Oregon, Portland, Andersen Machinery

Pa., Bradford, Bradford Supply Co.
Wilkes-Barre, Ensminger & Co.
Mechanicsburg, American Equip. Corp.
Philadelphia, Metalweld, Inc.

S. C., Columbia, Smith Equipment Co.

Tenn., Chattanooga, Dempster Bros., Inc.
Tenn., Knoxville, Dempster Bros., Inc.
Nashville, Dempster Bros., Inc.
Tex., Amarillo, T. W. Carpenter Equip. Co.
Abilene, W. T. McClure Mach. Co.
Dallas, Shaw Equip. Co.
Houston, So. Texas Equip. Co., Inc.
San Antonio, San Antonio Machy. & Supply Co.

Utah, Salt Lake City, J. K. Wheeler Mach. Co.

Vt., Barre, A. M. Flanders, Inc.
Va., Richmond, Highway Mach. and Supply Co.

W. Va., South Charleston, Allied Equip. Co.
Wash., D. C., Paving Supply & Equip. Co.
Wash., Seattle, Star Machy. Co.
Wash., Spokane, Star Machy. Co.
Wash., Yakima, Star Machy. Co.
Wisc., Milwaukee, Drott Tractor Co., Inc.

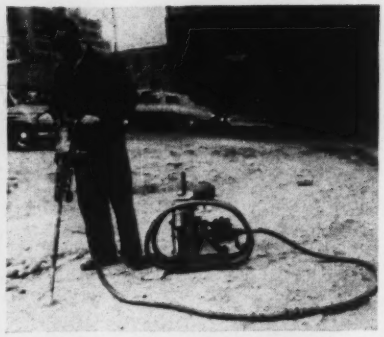
Ransome Distributors

O., Cleveland, H. B. Fuller Equip. Co.
Pa., Pittsburgh, Arrow Supply Company

Worthington Distributors

Ind., Indianapolis, Reid-Holcomb Company
Md., Baltimore, D. C. Elphinstone, Inc.
N. Y., N. Y., Air Compressor Rental & Sales.
O., Cleveland, Gibson-Stewart Co.
O., Columbus, Gibson-Stewart Co.
Pa., Pittsburgh, Atlas Equip. Co.
Texas, El Paso, Equip. Supply Co.
Wyoming, Cheyenne, Wilson Equip. & Supply Co.

Worthington Pump and Machinery Corp.
Worthington-Ransome Construction Equipment Division
Holyoke, Massachusetts



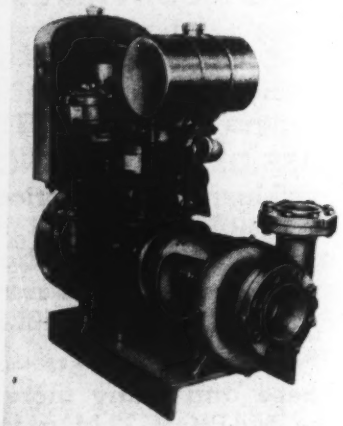
PORTABLE ROCK DRILL—A small gasoline or elecric motor with auxiliary air compressor transmits torque through a flexible shaft to a cam-and-piston drill hammer in the Pinazza rock drill, recently imported from Italy.

Compressed air is used only for blowing holes and for cushioning the rebound of the hammer piston. The cams pick up the rebounding piston and carry it to full compression in the drill cylinder, then release the piston for the driving stroke. Two models, weighing 35 and 41 lb., respectively, each deliver 1600 strokes per minute, the smaller model handling ¾-in. drill steel and the larger handling ¾-in. and 1-in. steel. The smaller model with its 3.5 hp. gasoline engine, compressor and flexible shaft weighs 114 lb. Weight of the larger complete unit, with 5.5 hp. engine, is 149 lb. For electrical installation, the smaller rig requires a 1½ hp. motor to drive the compressor, and a 1½ hp. motor to drive the flexible shaft. In the model using electric power, air from the compressor is blown through a flexible tube to cool the motor driving the flexible shaft, then the air travels through the flexible shaft housing and into the rock drill.—*Central Industries Ltd., 30 Church St., New York 7, N. Y.*

OIL BURNING HEATER—A new "Economy" model portable heater, using only one and one-half gallons of kerosene per hour, is now available for construction and other applications requiring temporary heat. This new unit incorporates complete separation of the products of combustion from the ventilating air stream, and gives forced hot air delivery to the areas where most needed. Motive power is supplied by a standard 1/3 h.p. electric motor. An unusual feature is the extremely low noise level during operation, made possible by a special propeller fan with airfoil profile. The heater has, as standard equipment, one 12-in. diameter by 12-ft. long, collapsible, canvas duct through which the heated air may be conveyed to the area where needed. The unit has sufficient capacity to heat almost two ordinary five-room houses.—*The Herman Nelson Corp., Moline, Ill.*

ELECTRODE FOR MACHINABLE WELDS—Nickelcast is a 100 percent nickel electrode for producing machinable welds on cast iron without preheating the metal. The welds are machinable both in the deposit and line of fusion and may be drilled, tapped, or machined at any point in the weld zone. The electrode is free from flourides and will not produce injurious gases. Coating is insulated to prevent arcing through when working in confined quarters. Can be used with either a.c. or d.c. welding current. Available in 3/32, ⅛, 5/32 and 3/16 in. diameters.—*Hobart Bros. Co., Troy, Ohio.*

LIGHTWEIGHT SCAFFOLD—Made of lightweight aluminum alloy, Up-Right scaffolds are available in any number of section units. Lock-in feature eliminates all wing nuts, bolts, loose parts and requires no wrenches. Each section folds flat. A 4½x6-ft. foundation area is standard with optional outboard supports available to provide a 10x10-ft. foundation area. A safety-tread stairway permits the user to mount the scaffold entirely within the structure.—*Up-Right Scaffolds, 1013 Pardee St., Berkeley, Calif.*



DIESEL-DRIVEN PUMP—Several 6 and 8-hp. pumps are now available powered by single-cylinder diesel engines equipped with electric starters. The diesel can be connected to the pump either directly or by a belt, depending on water depth or pressure required.—*Jacuzzi Bros., Inc., Richmond, Calif.* or *St. Louis, Mo.*

SOIL-SAMPLING KIT—Made up of 12 different earth augers, soil-sampling tubes, chopping and jetting bits and subsurface probing tools. In handy steel

Two of A. I. Savin Corporation's four 500′ Blue Brute Portable Air Compressors that are setting an example for dependable service

TOUGH GOING!... BUT BLUE BRUTES ARE TOUGHER!

On jobs like the Boston Post Road relocation project — with rock cuts containing 70,000 yds. in a single pocket — you soon find out what your air equipment can do!

A. I. Savin reports 100% satisfaction from Worthington Blue Brutes. It's easy to see why. Blue Brute 500′ Portable Air Compressors are packed with such advanced features as full force-feed lubrication and easy-breathing Feather* Valves—the most efficient ever made. No wonder these "portable powerhouses" have stood up under long, gruelling service without an extra minute down or an extra cent spent for repairs!

Also, Blue Brute UMW-40 Wagon Drills are the most versatile in the field . . . fast, powerful drilling machines that swing into action at any angle, to make short work of the toughest rock formation!

Adding up, here's a completely dependable air supply and air tools that make the most of it . . . a typical Blue Brute team that is beating schedules the country over. For further details that prove *there's more worth in Worthington*, see your nearby Blue Brute Distributor (listed on page 90) or write us direct.

*Reg. U. S. Pat. Off.

HS-8

HERE ARE THE FACTS

The A. I. Savin Corporation is using Worthington Blue Brutes to make a fast, economical job of one of the country's most difficult stretches of highway construction — 19,500 ft. straight through rocky, coastal Connecticut terrain on the relocated Boston Post Road.

Savin's Blue Brute 500′ Portable Air Compressors feed a battery of drills, wagon and hand-held. They have supplied air almost continuously for 5,000 hours at full rated capacity — without anything but routine, after-hours servicing!

The Blue Brute UMW-40 Wagon Drills on the project match this performance with consistent drilling through 22 ft. of mixed rock in 10 to 12 minutes!

Making fast speed through mixed rock! One of A. I. Savin's UMW-40 Blue Brute Wagon Drills in action

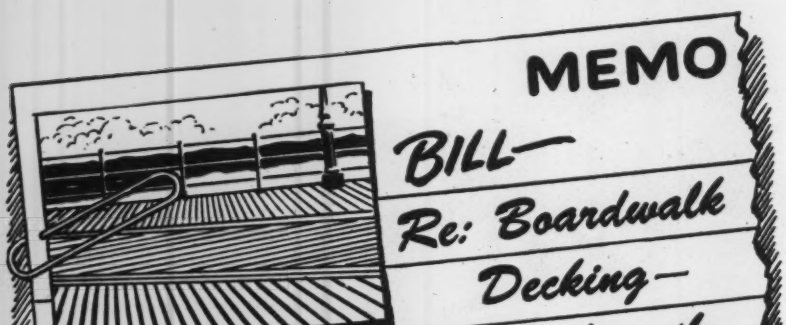
BUY BLUE BRUTES

WORTHINGTON

WORTHINGTON PUMP AND MACHINERY CORPORATION

Worthington-Ransome Construction Equipment Division, Holyoke, Mass.
Distributors In All Principal Cities

IF IT'S A CONSTRUCTION JOB, IT'S A BLUE BRUTE JOB

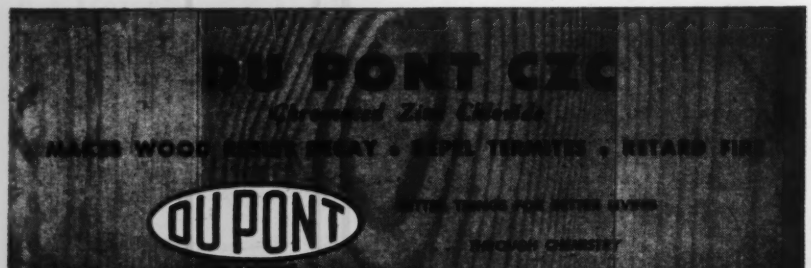


RESISTS DECAY: Boardwalk decking, caps and stringers are highly susceptible to decay—but wood that has been treated with Du Pont Chromated Zinc Chloride resists this costly damage—repairs and replacements are reduced wherever "CZC"-treated wood is used.

RETARDS FIRE: No chance for matches and cigarettes to cause fire in boardwalk decking built with "CZC"-treated wood. "CZC" gives wood greater protection against fire.

IMPROVES SAFETY: No danger of decking giving way because of decay, termites, or fire. "CZC"-treated wood resists these destructive forces—stays in better condition for a longer time.

Find out how "CZC"-treated wood can give your boardwalk deckings additional life. Write today for more detailed information. E. I. du Pont de Nemours & Co. (Inc.), Grasselli Chemicals Dept., Wilmington 98, Del.



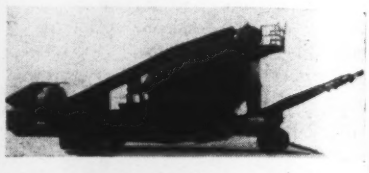
Stang WELLPOINT SYSTEM

For KNOW-HOW • ENGINEERING • SUPERVISION • EQUIPMENT • to keep jobs DRY

The Stang System has proved its efficiency and economy on both large and small jobs all over the United States. Stang engineering and supervision in planning, installation and operation insures a DRY JOB at all times.

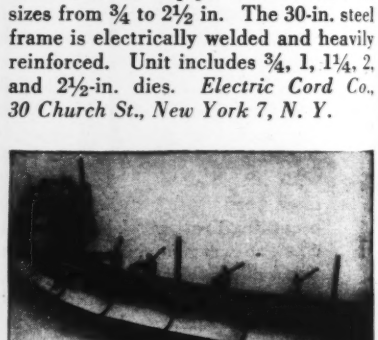
JOHN W STANG CORPORATION
2 Broadway, New York 4, N. Y.
8221 Atlantic Ave., P. O. Box 631, Bell, Cal.

box are ten drill rod sections 2 ft. 0 in. long, each made of cold drawn seamless steel tubing and having square threads and flush joints. To withstand hard driving by sledge or heavy maul, the steel tubing drill rods have a heavy shoulder. Cutting shoes are of hardened heat-treated steel. Complete kit may be conveniently placed in any automobile.—*Acker Drill Co., Inc., Scranton 3, Pa.*



SECONDARY STONE PLANT — Designed for agricultural lime-dust and road rock production, the model 1800 secondary stone plant consists of a Universal Hammermill on a truck with a double-deck vibrating screen, rotovator, conveyors, hoppers, and necessary drives. Material from a primary crusher goes directly to the screen, and oversize is delivered to the hammermill. The model 1800 is available with three hammermill sizes with aglime capacities from 20-75 tons per hour and road stone from 50-125 tons per hour. —*Universal Engineering Corp., Cedar Rapids, Iowa.*

PORTABLE PIPE BENDER — Weight of jack and frame of hydraulically operated unit is only 83 lb. Jack is readily removable from frame and can be used for other purposes. Device bends standard pipe and conduit in sizes from ¾ to 2½ in. The 30-in. steel frame is electrically welded and heavily reinforced. Unit includes ¾, 1, 1¼, 2, and 2½-in. dies. *Electric Cord Co., 30 Church St., New York 7, N. Y.*



FLEXIBLE STEEL FORM IMPROVEMENT — New development supports face forms by overhead hangers permitting concrete curb construction of any length without breaks or scoring of concrete. There is ample clearance beneath overhead hanger for hand finishing. Position of hangers on forms is adjustable to allow for obstacle interference.—*Heltzel Steel Form & Iron Co., Warren, Ohio.*

Manufacturers' Publications

Heavy Duty Transmissions—A 12-page catalog contains complete specifications on unit-mounted, auxiliary and amidship-mounted transmissions. Gear ratios, weights, dimensions and other installation information are listed. Preliminary selection of transmissions may be made from the catalog. A specification sheet included should be filled out for definite recommendations by Fuller engineers.—*Fuller Manufacturing Co., Transmission Division, Kalamazoo, Mich., or Western District Office, Fuller Manufacturing Co., 1060 East 11th Street, Oakland 6, Calif.*

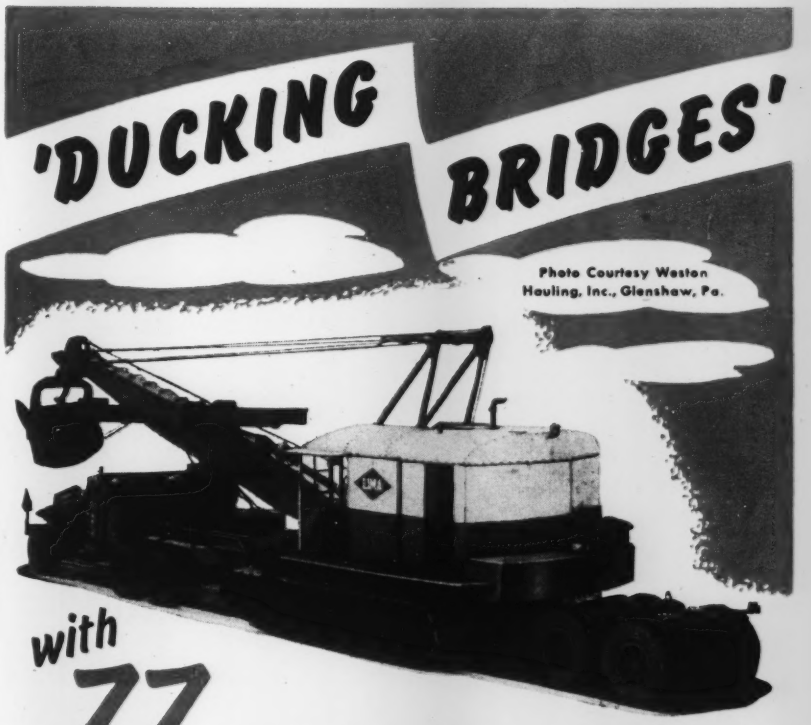
Tractors—A new bulletin describing Allis-Chalmers' improved IB wheel tractor has been released by the company's Tractor Division. A page of action pictures emphasizes the tractor's flexibility and illustrates its wide application in municipalities and industry.—*Allis-Chalmers Mfg. Co., Tractor Division, Milwaukee 1, Wis.*

Wire Rope—"The Wonders of Wire Rope" is the title of a booklet in comic strip style which tells how wire rope saves a boy's life, and incidentally outlines the whole story of wire rope making and how wire rope is used in industry. This is unusual advertising for a manufacturer.—*Broderick & Bascom Rope Co., St. Louis, Mo.*

Power Saws—An illustrated booklet has been issued on the Kut-Kwick portable power saws with a circular blade that can be used horizontally for felling trees or vertically to saw logs.—*Kut-Kwick Tool Corp., 1927 Newcastle St., Brunswick, Ga.*

Portable Air Tools (folder). Catalog pages cover paving breakers, clay diggers, trench diggers, backfill tampers, sinker rock drills, drifter rock drills, and nail driver. Also included are electric hammer, sump pumps, pneumatic and electric saws, concrete surfacing grinders, and accessories, such as hose couplings and fittings. All of these products bear the trade name of Thor.—*Independent Pneumatic Tool Co., Aurora, Ill.*

Steel Buildings (6-p. folder). Describes and illustrates uses and advantages of standard Armco Steelox buildings. Includes general data showing range of sizes, types of doors and windows, partitions, ceilings, louvres,



with 77 TONS OF SHOVEL ON A ROGERS GIRDER TYPE TRAILER

These heavy duty trailers are designed and built for the lowest possible road clearance.

Although not limited to such work they are used to a large degree in the transporting of crawler-mounted machinery of large size.

Rogers Girder Type Trailers have proven indispensable in areas where low bridges are prevalent or where other limited headroom clearances are encountered.

Illustrating 8-wheel rear assembly. Four-wheel assembly is also available.

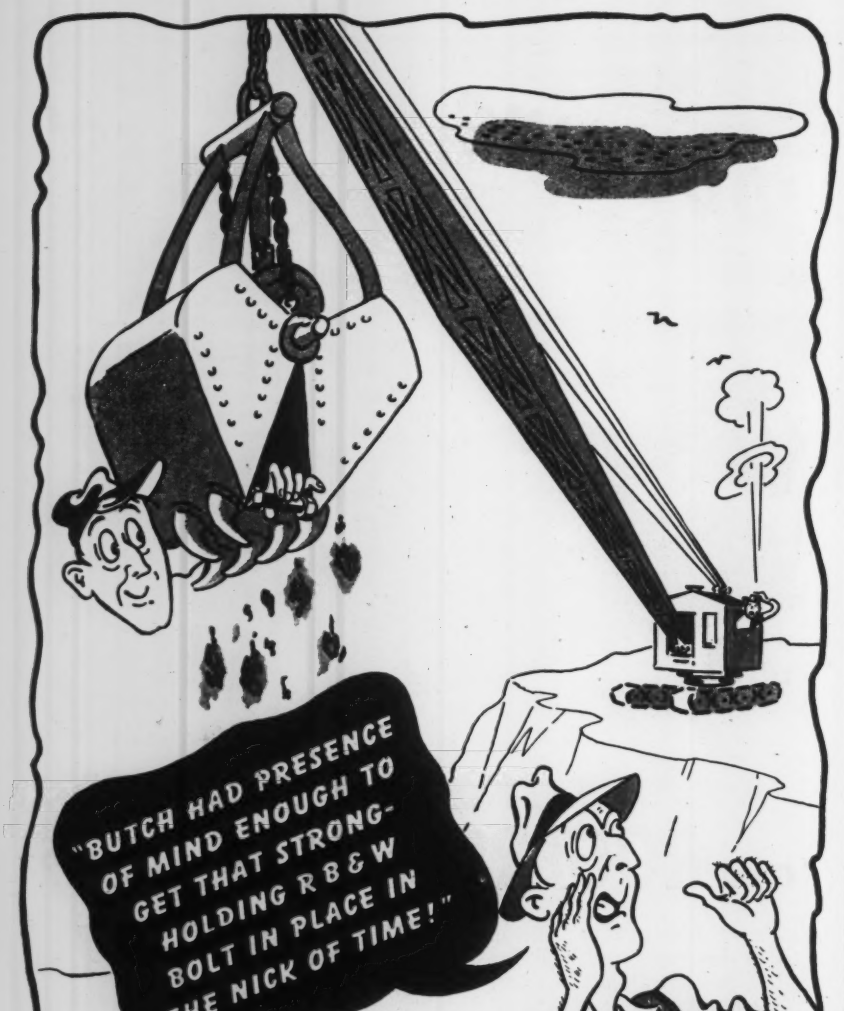
Loading is accomplished by removing the rear wheel assembly. The machine moves into position over the girder. The frame is then jacked up and rear wheels attached. The load is in position ready to roll.

ROGERS BROS. CORP.

DESIGNERS and BUILDERS OF HEAVY DUTY TRAILERS SINCE 1915

EXPERIENCE builds 'em PERFORMANCE sells 'em

135 ORCHARD ST. ALBION, PENNA.



Use R B & W Bolts and Nuts . . .

Quick-starting, quick-tightening because they are accurately, uniformly sized and threaded — and carefully inspected.

Vibration-resisting, shock-resisting because the manufacturing method insures extra strength, and all processing is controlled from raw rod to finished product.

EMPIRE BOLTS NUTS RIVETS — AND ALLIED FASTENING PRODUCTS .. SINCE 1845

RB&W *Making strong the things that make America strong*

Russell, Burdsall & Ward Bolt and Nut Company. *Factories at* Port Chester, N. Y., Rock Falls, Ill., Coraopolis, Pa., Los Angeles, Calif.; *additional sales offices at* Philadelphia, Chicago, Detroit, Chattanooga, Oakland, Portland, Seattle

and ridge ventilators. Illustrations show how wall panels, roof panels, and top plates are assembled in field.—*Armco Drainage & Metal Products, Inc., Middletown, Ohio.*

Treated Wood—(150-p. loose-leaf book). Revised manual of standards for treated wood condensed to essential details. Standards are grouped for easy reference under such heads as Preservatives, Treatments, Methods of Analysis, and Recommended Practices. Designed to be helpful to specification writers, design engineers and architects, railroad purchasing agents, contractors, builders, and those concerned with heavy or residential construction.—*American Wood Preservers Association, 1427 Eye St., N. W. Washington 5, D. C.*

Strong Grips — An unusual and interesting folder describes and illustrates a wide variety of grips and material handling devices produced by this manufacturer, including three new items developed at the request of the Naval Aeronautics Division. The mere listing of some of the company's chief items indicates the scope of its offerings in the construction field. These include trip hook, package cradle, adjustable box grab, and the following—drum, barrel, box, plate, tong, screw type, and binder grips. With the latter any amount of slack can be taken up without loosening any of that which has already been passed through the master grip—*Smith Devices, 331 N. 4th St., Philadelphia, Pa.*

Joint Sealing Compound—6-page folder gives information about a hot-poured thermoplastic rubber asphalt joint sealing compound for concrete pavements which is widely used in airport and highway work.—*Industrial Products Division, The Flintkote Co., 30 Rockefeller Plaza, New York City, N. Y.*

Construction Pumps—A 12-page bulletin lists 17 different series of self-priming centrifugal pumps and 3 series of diaphragm pumps especially designed for construction work. Among the self-priming centrifugals described is the newest Marlow "Water Wizard" pump for contractors, the Series 430, 40M, 4-in. suction and discharge.—*Marlow Pumps, Ridgewood, N. J.*

Three-quarter Yard Excavator—Specifications, technical data and job applications concerning a ¾-yd. excavator are contained in a 16-page catalog. The job portion of the booklet has some unusually fine photographs.—*The Byers Machine Co., Ravenna, Ohio*

Manufacturers' Activities

Sales—John S. Conway, formerly export sales manager of the KOEHRING Co. of Milwaukee, Wis., has been appointed general sales manager. . . . Frank J. Smith is advertising and sales promotion manager of the PHILIP CAREY MFG. Co., Cincinnati, Ohio. . . . Gerald T. Haddock is American sales representative of LAFARGE ALUMINOUS CEMENT Co., LTD., of London, England, with temporary headquarters at 311 E. 72d St., New York 21, N. Y. . . . R. K. Gottshall, formerly director of sales of the explosives department of ATLAS POWDER Co. is now assistant general manager and is succeeded by W. E. Collins, Jr. Both will be at the Wilmington, Del., office. G. W. Thompson is transferred from the New York to the Seattle office as manager of that district sales office. . . . C. R. Fischer is sales representative for New Jersey and the eastern half of Pennsylvania for the GEO. P. REINTJES Co., Kansas City, Mo. . . . G. C. Stafford has joined the sales staff of MCCULLOUGH TOOL Co., Los Angeles, Calif. . . . Sherrill S. Deputy is sales manager of AMERICAN WHEELABRATOR & EQUIPMENT CORP., Mishawaka, Ind. . . . John E. Meroney is district sales manager at St. Louis for INLAND STEEL PRODUCTS, Milwaukee. . . . Lew Krafts is vice-president and general sales manager of the UNIVERSAL MOTOR Co., Oshkosh, Wis. . . . Salesmen of the building material sales division of the PARAFFINE COMPANIES, INC. for 11 western states recently attended a sales conference at the home office in San Francisco. . . . EASTCOAST EQUIPMENT Co., INC., Garwood, N. J., is the new sales agent for LIMA SHOVEL and CRANE division in northern New Jersey. . . . Robert R. Rector is district representative for THE AMERICAN COACH & BODY Co., Cleveland, Ohio for the southern division. . . . C. M. Baumgardner is vice-president for sales of the NATIONAL RADIATOR Co., Johnston, Pa., in place of President John C. Barnes, resigned. . . . G. Luke Mizell has been appointed to the board of regional sales supervisors of the EUTETIC WELDING ALLOYS CORP. in the middle and south Atlantic states and Wm. R. Bajari in the western region. . . . R. R. Boand, formerly district sales manager at Chicago for the UNION WIRE ROPE CORP. is now sales manager for Tuffy slings at 21st and Manchester, Kansas City, Mo. . . . A. E. Johnson, formerly assistant field sales manager of the FOUR WHEEL DRIVE

---on cutting • fuel bills in Half

During New England's severe winter of 1947-8, the J. C. Corrigan Company, Inc., of Dorchester, Mass., *cut its fuel bill nearly 50%* by installing a DRAVO *Counterflo* Heater. Coal for the previous winter season had cost this company between $1100.00 and $1200.00, whereas only $652.00 was spent for oil to fuel the DRAVO Heater during a similar period.

Besides fuel savings, the maintenance expense for the old heating system was practically eliminated because the DRAVO Heater operates automatically by thermostatic control. "Even more important" says J. C. Corrigan, President, ". . . part of our substantial increase in production this winter was due to the improved heating system."

Employees in the Corrigan plant manufacture custom-built conveying systems and need adequate warmth for efficient fitting and assembling. Previously, the plant was heated by a coal burning furnace using blowers and ductwork to distribute the warm air. Excessive roof heat losses in this 165' x 70' x 27' building prevented it from being comfortable. To heat "cold spots" that developed, eight pot-bellied stoves were installed. Maintenance of this old heating method required three hours labor every day. Coal and ashes had to be hauled through the heart of the busy plant. Even with the eight stoves to supplement the coal-fired furnace, heat was inadequate and employees spent valuable production time huddling around the stoves.

In November 1947, one DRAVO *Counterflo* Heater with an output capacity of 2,000,000 Btu was installed. No ductwork was needed. Only fuel and power lines had to be connected and a vent stack installed. Now the entire factory area is maintained at the proper degree of warmth for workers' comfort and efficient production.

During sub-zero weather last winter, the single DRAVO Heater delivered enough heat within 20 minutes after it was turned on to satisfy the thermostat's setting. Moreover, the DRAVO Heater is shut down to conserve fuel during non-working hours, whereas the coal furnace had to be fed over week-ends while the plant was not in operation to maintain some warmth for the Monday morning shift.

DRAVO *Counterflo* Heaters burn oil, gas or coal. Units burning non-solid fuels can be converted from one fuel to another very readily. Coal-fired heaters can be converted for burning gas or oil.

DRAVO CORPORATION, *Heating Section,* Dravo Bldg., Fifth and Liberty Avenues, Pittsburgh 22, Pa.

DRAVO CORPORATION

★

Pittsburgh • Cleveland • Philadelphia • Detroit • New York • Chicago • Atlanta • Boston
Sales Representatives in Principal Cities

DRAVO

5 Function Heating with just **ONE** UNIT

DRAVO CORPORATION, Heating Section, Room 812-9
Dravo Bldg., Fifth and Liberty Avenues, Pittsburgh 22, Pa.
We would like to consider DRAVO *Counterflo* Heaters for:

Name..... ☐ Comfort Heating
Title..... ☐ Year 'round Ventilating
Company..... ☐ Process Drying
Address..... ☐ Tempering Make-up Air
City and State..... ☐ Heat Curing
P-6374

PROTEX AEA* INCREASES CONCRETE DURABILITY OVER 700%

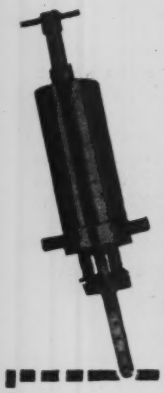
*Air-entraining Agent

Concrete WITHOUT Air-entrainment
Silicious Aggregate

This sample failed at 100 cycles of freezing and thawing. Expansion 0.6%. Weight loss 25%. Since 25% loss is considered equivalent to failure, further cycles of freezing and thawing were discontinued on the above sample.

Air-entrained Concrete—4.0% Air
Silicious Aggregate

After 300 cycles of freezing and thawing the expansion was 0.2% and the weight loss was 4%. The above sample shows direct advantages that occur through use of air-entrainment in concrete.



This test conclusively proves one of the many important advantages of PROTEX AEA. Also, PROTEX air-entrained concrete is more workable, dumps, spreads and finishes more easily—saves time—labor—money! Gives concrete resistance to alkali-sulphate disintegration, improves resistance to scaling. Can be hauled without agitation, and in general protects the concrete against the usual causes of failure. It's tried! It's proven! Fully approved and widely used by U. S. Government agencies and A. G. C. Contractors. Specify PROTEX and get the best AEA.

LOW COST PROTEX DISPENSER...AUTOMATICALLY DISPENSES PREDETERMINED AMOUNT OF AEA.

Serving industry for 27 years.

FREE BOOK ON AIR ENTRAINMENT

AUTOLENE LUBRICANTS CO.
Industrial & Research Division, Denver 9, Colorado

Please send me your book, "Facts on Modern Placement of Concrete Through Air Entrainment."

*Name*_____

*Address*_____

MacArthur

38 YEARS INSTALLING PILES OF EVERY TYPE

CAST-IN-PLACE CONCRETE COMPOSITE
STEEL SECTIONAL PIPE TIMBER
SOIL AND ROCK BORINGS

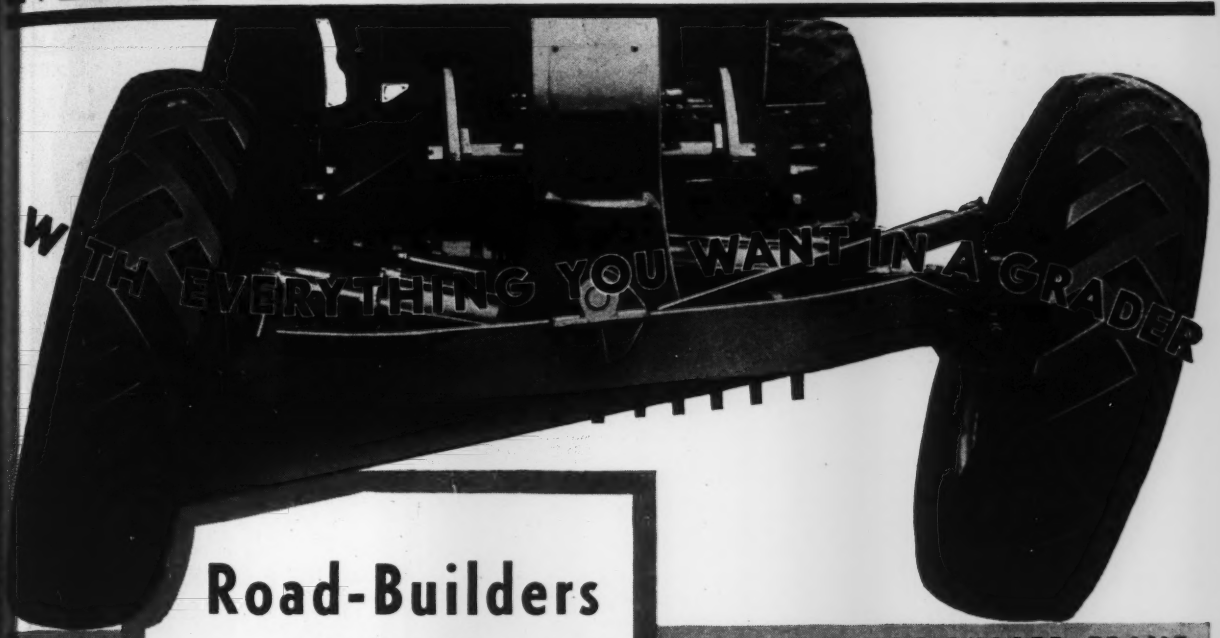
MacARTHUR CONCRETE PILE CORPORATION
18 EAST 48th STREET, NEW YORK 17, N. Y.
BOSTON • CINCINNATI • NEW ORLEANS

AUTO Co., has been named supervisor of government sales. C. A. Rogers, who has specialized in fire truck sales, has been named supervisor in that market. Lloyd Scheider, formerly assistant to General Manager Robert A. Olen, is supervisor of defense sales. Leo Polzin, formerly field sales manager, has been appointed manager of national accounts. Stanley Wick, formerly manager of the order department, has been appointed assisant director of sales in charge of all office domestic sales; and Jack Kelly, formerly assistant field sales director, has been appointed assistant director of sales in charge of administration of the field organization. John Battes, sales supervisor in northern California and Idaho, has been named acting manager of the western sales zone. Howard Collard, formerly sales supervisor in Oregon and Washington, has been named acting zone manager in the southeastern states.

Distributors—SHIPPING UTILITIES, St. Louis, Mo., is the new truck distributor for HYSTER CO. in 36 counties of Missouri and 50 counties of Illinois. . . . Paul N. Clemens is exclusive agent in Connecticut, Massachusetts and Rhode Island for LITHCOW CORP., Chicago, applicators of resin baking finishes on tanks, pipe and other equipment. . . . RITCHIE EQUIPMENT CO., LLD., Vancouver, B. C., is direct factory distributor for DAVEY COMPRESSOR CO., Kent, Ohio.

Personalities—J. J. Murray is export manager for HEWITT-ROBINS, INC., New York. . . . Paul H. Weiderman is general manager of THE UNION IRON WORKS of NEW JERSEY CO., INC. . . . C. M. Gegenheimer is district manager for MARION POWER SHOVEL CO. at Chicago. . . . W. P. Gillespie is manager of the market requirements department of HENRY DISSTON & SONS, INC., saws, tools and special alloy steels. . . . O. D. Shepard has been elected president of D. C. ELPHINSTONE, INC., construction equipment, Baltimore, Md., and Washington, D. C. . . . Otto J. Hartwick has been named technical director of the Houston paint division of PITTSBURGH PLATE GLASS CO., M. G. Gardner of the Newark, N. J. division, and R. T. Ubben at Milwaukee, Wis. . . . E. P. Newhard is operating manager of the PENNSYLVANIA-DIXIE CEMENT CORP., New York, in place of C. J. Lofstedt, resigned. . . . Melvin A. Staben is district manager for all industrial business of the OLIVER CO. in Oregon, Washington, Idaho and Montana. . . . Geo. S. Ames is special representative of the service department of Findlay division of GAR WOOD INDUSTRIES, INC. and John D. Blood is division service

MASSIVE POWERHOUSE



Road-Builders get RESULTS with WARCO D-76 MOTOR GRADER

Just what you want in a grader . . . size . . . weight . . . strength . . . operating ease . . . economy . . . you'll find them all in the WARCO Model D-76.
This MASSIVE POWERHOUSE . . . designed to "on-the-job" requirements . . . smooths out the toughest road-building problems.

See this hard-hitting baby in ACTION. Contact your WARCO dealer and learn ALL the facts.

HEAVIER, MORE RUGGED FRAME

STURDY FRONT AXLE ASSEMBLY

FULL 76-H.P. DIESEL ENGINE

13.00 x 24 TIRES ALL AROUND

GREATER FRONT AXLE CLEARANCE

POWERFUL TANDEM DRIVE

HYDRAULIC CONTROL

THE W. A. RIDDELL CORP.
BUCYRUS, OHIO

Manufacturers of
WARCO MOTOR GRADERS
RIDDELL ROAD ROLLERS

FOR THE UTMOST IN RUST PREVENTION

OFFICIAL • INSIGNIA • GALVANIZED PRODUCTS
HOT-DIP GALVANIZING
AMERICAN HOT-DIP GALVANIZERS ASSOCIATION INC.

This Symbol of Membership is your Assurance of a Job well done—

It tells you that each member of this Association has access to the accumulated "know-how" and experience of the entire membership.

It is your assurance of the highest standards of quality in materials and workmanship, the latest in equipment and most modern of galvanizing methods.

Write the Association Members nearest you. They will gladly give you estimates or information on any galvanizing requirements.

ALABAMA
THE LERIO CORPORATION, MOBILE

CONNECTICUT
WILCOX, CRITTENDEN & CO., INC., MIDDLETOWN

GEORGIA
ATLANTIC STEEL COMPANY, ATLANTA

ILLINOIS
EQUIPMENT STEEL PRODUCTS, BLUE ISLAND
JOSLYN MFG. & SUPPLY CO., CHICAGO
STANDARD GALVANIZING CO., CHICAGO

MARYLAND
SOUTHERN GALVANIZING CO., BALTIMORE

MICHIGAN
RIVERSIDE FOUNDRY & GALV. CO., KALAMAZOO

MISSOURI
COLUMBIAN STEEL TANK CO., KANSAS CITY
MISSOURI ROLLING MILL CORP., ST. LOUIS

NEW JERSEY
DIAMOND EXPANSION BOLT CO., INC., GARWOOD
L. O. KOVEN & BROTHER, INC., JERSEY CITY
INDEPENDENT GALVANIZING COMPANY, NEWARK

NEW YORK
THE THOS. GREGORY GALV. WORKS, MASPETH
JEFFERSON UNION COMPANY, INC., NEW YORK

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THE FANNER MFG. CO., CLEVELAND
THE NATIONAL TELEPHONE SUPPLY CO., CLEVELAND
THE WITT CORNICE COMPANY, CINCINNATI
COMMERCIAL METALS TREATING, INC., TOLEDO

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LEHIGH STRUCTURAL STEEL CO., ALLENTOWN
PHILA. RANGE BOILER & TANK CO., COATESVILLE
COLUMBIA MALLEABLE CASTINGS CO., COLUMBIA
AMERICAN TINNING & GALVANIZING CO., ERIE
HANLON-GREGORY GALVANIZING CO., PITTSBURGH
OLIVER IRON & STEEL CORP., PITTSBURGH
PENN GALVANIZING COMPANY, PHILADELPHIA

TENNESSEE
COMBUSTION ENGINEERING CO., INC., CHATTANOOGA
M. M. HEDGES MFG. COMPANY, INC., CHATTANOOGA

WASHINGTON
ISAACSON IRON WORKS, SEATTLE

WISCONSIN
ACME GALVANIZING, INC., MILWAUKEE

hot-dip GALVANIZING

manager. . . . R. F. Dierking is manager of west-central offices of the PORTLAND CEMENT ASSN., succeeding R. M. Winters, resigned. Fred F. Loy is the new Iowa district engineer to succeed Mr. Dierking. . . . Wm. A. Penrose is now assistant secretary of the AMERICAN WOOD-PRESERVERS' ASSN. . . . Frank Bochman will handle sanitary engineering in Florida for THE DORR CO., N. Y.

Miscellany—Executive committee of ASSOCIATED EQUIPMENT DISTRIBUTORS is meeting this week in Denver, Colo., and on Oct. 1–2 the conference for Colorado, Utah, Wyoming, New Mexico and El Paso, Tex., will also be held in Denver. . . . Rubber lining of storage tanks, tank cars, pipe lines and other equipment will be added to other products of the Tuscaloosa, Ala., plant of the B. F. GOODRICH CO. . . . U. S. PIPE and FOUNDRY CO., will build a plant at Richmond, Calif., for cast iron pressure pipe made by the centrifugal process. . . . ACTIVATED ALUM SALES CORP., 516 N. Charles St., Baltimore, Md., has been organized to be active in the water works field. . . . A 3-year program for extension of development and production operations has been started by the Brown division of MINNEAPOLIS-HONEYWELL REGULATOR CO. as the second step in its $2,500,000 physical expansion. . . . Expansion and modernization costing more than $80,000,000 has raised the production capacity of U. S. RUBBER Co. to the highest peak in its history. . . . PETTIBONE MULLIKEN CORP., Chicago, has bought the UNIVERSAL ENGINEERING CORP. of Cedar Rapids, Iowa, manufacturers of crushing machinery and allied equipment for rock and gravel plants. . . . ROBINS ENGINEERS division of HEWITT-ROBINS, INC., has tripled its backlog of contracts in its first eight months as a separate division. . . . TIMKEN ROLLER BEARING CO. has announced that all products of the steel and tube division will be sold, quoted and invoiced f.o.b. mill. . . . UNIT MFG. CO., Columbus, Ohio, has acquired the facilities of the BIGELOW MFG. CO. The purpose is to make and sell brake service and materials handling equipment. . . . Consolidation of the shops and piston ring division of KOPPERS CO., INC., into a new metal products division is taking place. . . . A new tile plan with a capacity of 50,000 four-inch tile per week will be built by THE LAVEY POTTERY & TILE CO. at Milan, Ohio.

Canada—Authorization to build a $2,000,000 hydro-electric project on the Ottawa River near Sullivan Island has been granted the Gatineau Power Co. by the Province of Quebec. The project is designed to provide an additional 27,000 hp. to farms and industries in western Quebec.

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Men and Jobs

A. E. Williamson, Jr., has become associated with the Florida office of Russell and Axom, consulting engineers in Datona Beach. Before the war he was associate sanitary engineer with the Florida State Board of Health. In the war he served in the Sanitary Corps in South America, and for the last year he taught sanitary engineering at North Carolina State College.

John A. Beane, consulting engineer, has been appointed dean of Millard Fillmore College in Buffalo, N. Y. He is a partner in the firm of Sloan, Beane and Thompson, Buffalo, architects and consulting engineers.

Marvin E. Ray, city engineer at Vancouver, Wash., has resigned to enter private practice in Vancouver.

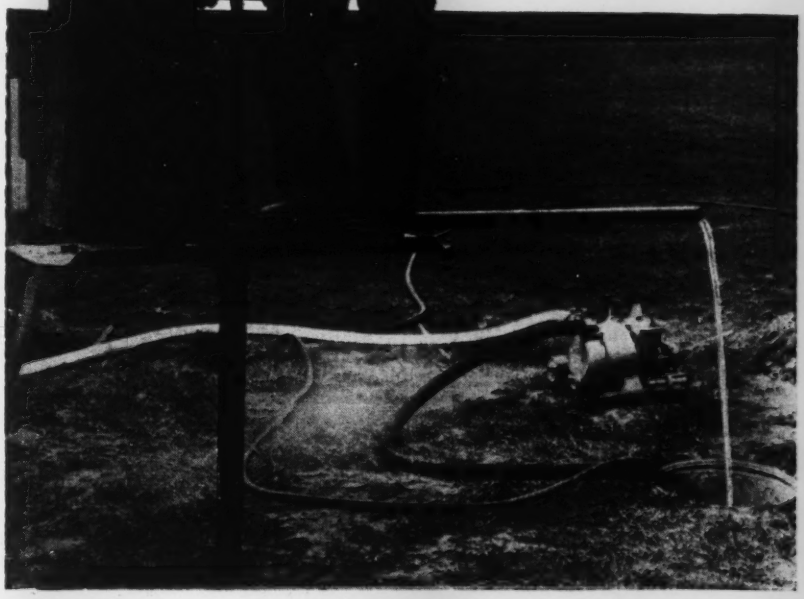
Recent personnel changes in the West Virginia highways department are: ***James R. Marshall*** has been employed as maintenance superintendent of Jefferson County, District Five; **Silvester Mazzella** has resumed as regional equipment inspector, equipment and supply section, maintenance division, Charleston; **Lee Ellis** has been named maintenance superintendent of Roane County, District Three; **John J. Lane** is district safety director, District One, in place of Lowell Lanham; **H. K. Griffith,** senior maintenance assistant, has been promoted to senior engineer, District Four maintenance division; **Delbert Stalnaker** has been reemployed as assistant maintenance superintendent of Gilmer County, District Seven; **A. L. McMillion** has been promoted from senior maintenance assistant to senior engineer, District Nine; and **Orton Mercer** is assistant district right of way agent, right of way Department, District Three.

C. Carter Brown and **Charles M. Butler** have formed the firm of Brown & Butler, civil engineers at Baton Rouge, La., with offices on the 2d floor of the Illinois Central R. R. station.

E. A. Thompson, has been appointed town engineer and manager for Sackville, N. B.

The Public Roads Administration of the Federal Works Agency announces that its district office at Juneau, Alaska, has been raised to the status of a division office. **Hugh A. Stoddart,** formerly highway engineer in the district office at

FOR FAST AND LOW COST ACCURATE KNOWLEDGE OF BEDROCK CONDITIONS



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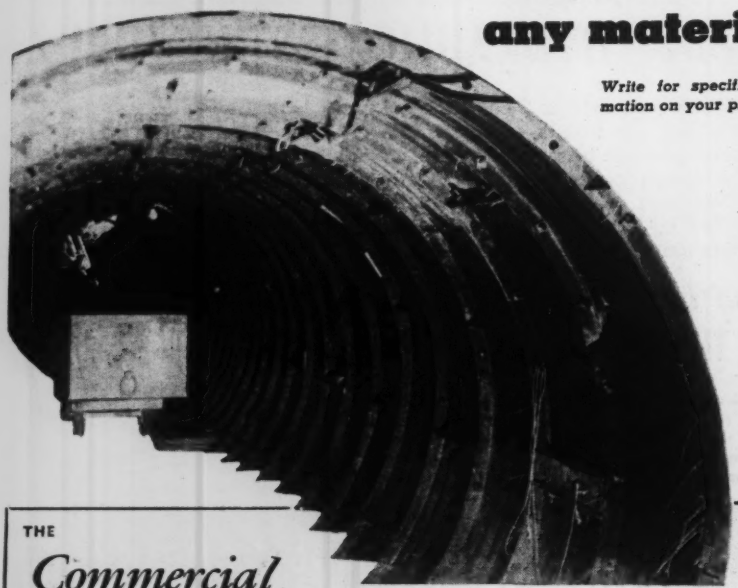

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Portland, Ore., will be division engineer, supervising highway work in national forests and work in cooperation with other federal agencies in Alaska.

W. Roy Grace has resigned as division engineer for the Oklahoma state highway department at Ada and is succeeded by **Earl Anderson,** assistant state maintenance engineer.

Norman D. Urquhart, superintendent of gas operations for South Carolina Electric & Gas Co., Columbia, S. C., has been named superintendent of the company's $13,500,000 construction program. Mr. Urquhart supervised the Saluda Dam at Dreher Shoals on the Saluda River (then the largest earthern dam in the world); the generating station at Parr Shoals, and other utility projects.

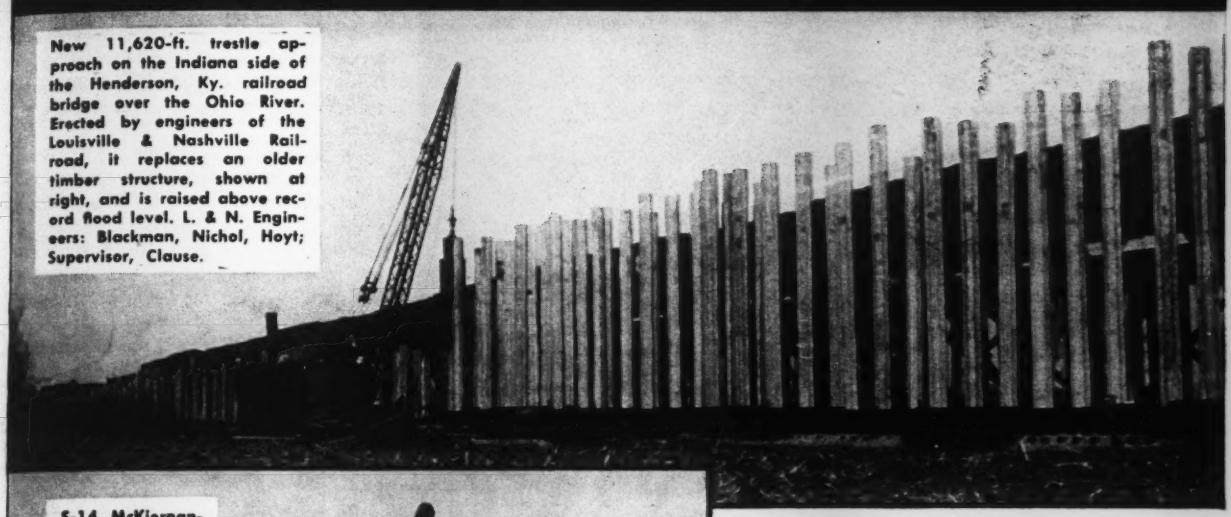
Robert O. Swain, formerly inland transport advisor, Office of Transportation and Communication, U. S. State Department, has become assistant director, International Road Federation, Washington, D. C. Following graduation from Denison University, Ohio, and a year of graduate work in traffic engineering at Harvard, Mr. Swain worked with the Texas Highway Department on construction and traffic. During the war he served as a major in the Corps of Engineers.

John F. Deeds, principal engineer in the conservation branch, U. S. Geological Survey, has retired after 37 years of federal service. In 1910 he started as a draftsman for the topographic branch of the Survey. From 1912 to 1917 he was engaged in reporting on power and reservoir site resources of rivers. He became chief of the agriculture division of the Survey in 1917. After creation of the grazing division in the Interior Department, he became deputy director. He originated much of the program to conserve grazing resources and prevent soil erosion. In 1936 he returned to the Survey to take charge of the oil and gas unit plan work.

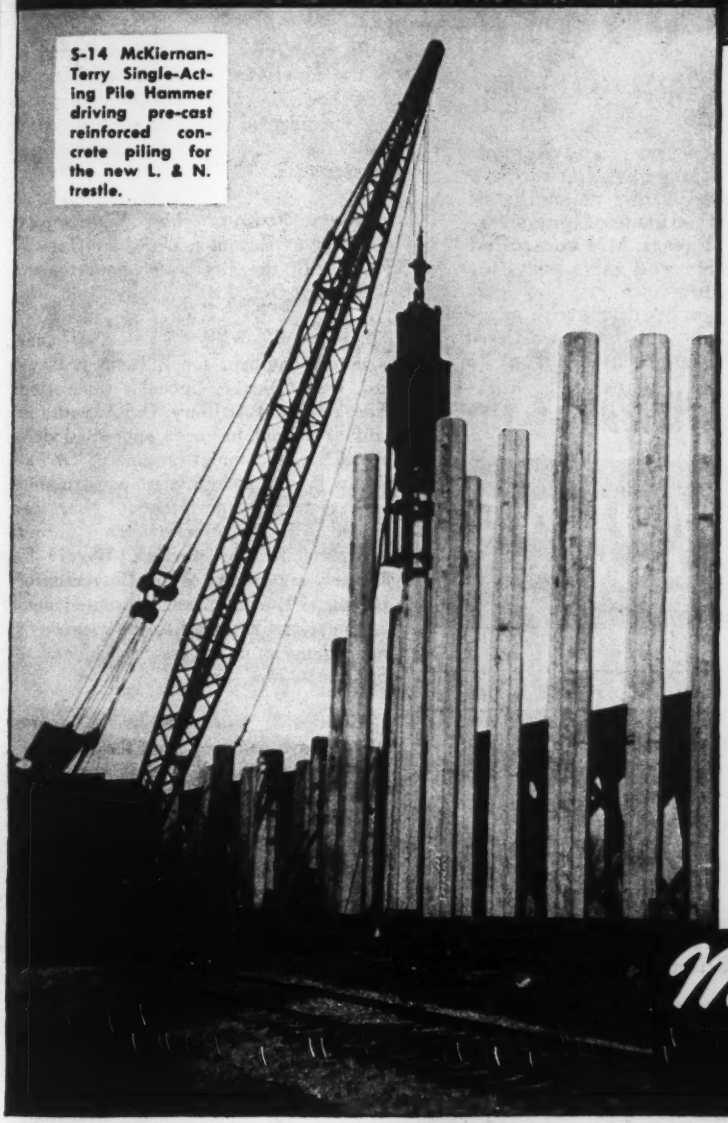
George M. Tapley, who has been in charge of civil works project planning for the Office of Chief of Engineers, Department of the Army, has been transferred to the Alaska Road Commission, Interior Department, Juneau, Alaska, where he will be assistant chief engineer in charge of contract work for the construction and hard surfacing of Alaskan highways.

Claude R. Whitaker, 70, has retired from the Public Roads Administration. He entered government service in 1919 as a highway engineer, and has been with Public Roads since then. For the

2225 PILES Driven Accurately



New 11,620-ft. trestle approach on the Indiana side of the Henderson, Ky. railroad bridge over the Ohio River. Erected by engineers of the Louisville & Nashville Railroad, it replaces an older timber structure, shown at right, and is raised above record flood level. L. & N. Engineers: Blackman, Nichol, Hoyt; Supervisor, Clause.



S-14 McKiernan-Terry Single-Acting Pile Hammer driving pre-cast reinforced concrete piling for the new L. & N. trestle.

Unusual length—over two miles—makes this single-track structure a noteworthy job of pile-driving. That the Louisville & Nashville engineers who handled the project chose a McKiernan-Terry hammer is one more tribute to McKiernan-Terry's half-century reputation for dependability and power in pile driving equipment.

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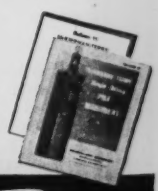

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last 15 years he has been in the office of the division engineer in charge of road planning and construction in the National Park and National Forest areas in the eastern half of the United States. He was in charge of the receipt of bids and the preparation of contract documents for highway construction, particularly for the Skyline Drive, the Blue Ridge Parkway and the Natchez Trace Parkway.

Waldo Wegner, who resigned recently as city engineer for Mason City, Iowa, has become city manager for Chariton. Before going to Mason City in November, 1945, he had been an assistant engineer for Cedar Falls, Iowa.

Robert J. Richardson recently named assistant county engineer under J. W. Wiersma, county engineer for Grundy County, Iowa, formerly was assistant county engineer for Osceola County at Sibley.

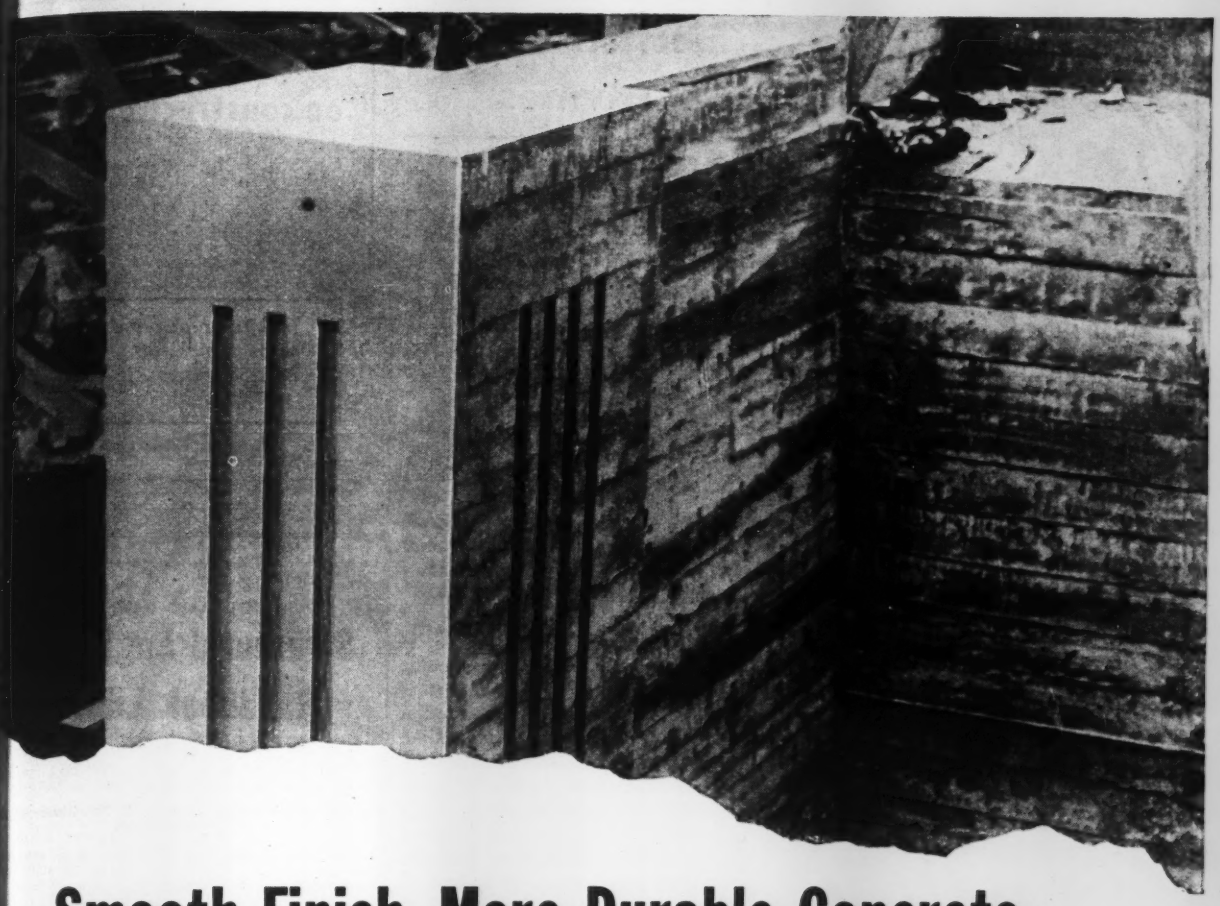
E. H. Kreig, chief design engineer of the American Gas & Electric Corp., New York, has been appointed consulting engineer of Stone & Webster and will have headquarters in their Boston, Mass., office.

Albert Nething, chief Waterworks engineer at Ravenna, Ohio, and for 21 years with the city water department, will retire Oct. 1.

Walter E. Willard, principal construction engineer for William J. Howard, Inc., Chicago, since his separation from the Field Artillery, U.S.A. with the rank of colonel, has been appointed vice-president and chief engineer. **A. S. Burns** for the last 15 years construction and general superintendent has resigned. **S. J. MacEachern,** former superintendent of erection. **Harold E. Turner,** a graduate of the University of Illinois, 1946, has been appointed field engineer and assigned to the company's operations on the East St. Louis, Ill.-St. Louis, Mo., bridge.

Charles J. Wurmfeld and **Eric Singleton** have resigned from the engineering firm of Gibbs & Cox to open their own consulting engineering offices at 150 Nassau Street, New York City. Mr. Wurmfeld has specialized in the engineering design of heating systems for over twenty years. Mr. Singleton was associated with him for six years and has had long experience as a builder.

Robert R. Ellis, civil engineer, of Weslaco, Tex., has been appointed superintendent of public works for Takoma Park, Md., succeeding **Maj. W. F. Fischer,** USMC, retired, who has held the post for the last 25 years.



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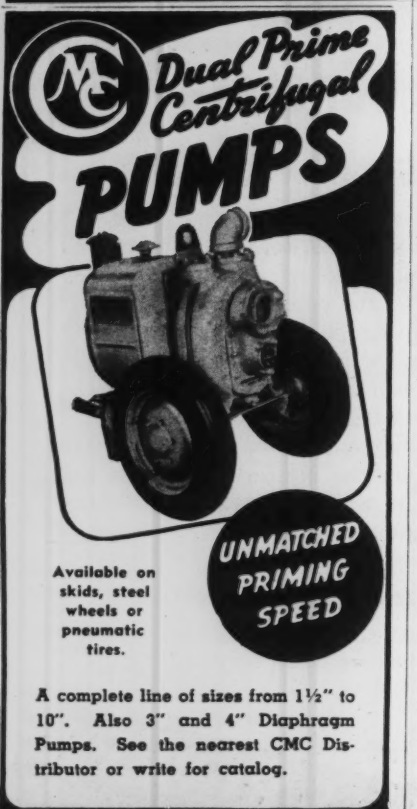

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Elections and Activities

At the meeting of the Kentucky-Tennessee Industrial Waste and Sewage Association, Grant S. Bell, of Lexington, Ky., was elected chairman. Other officers include S. Larry Jones, Nashville, vice-chairman; R. P. Farrell, Nashville, secretary-treasurer, and James Ellis, Kingsport, Tenn., national director.

C. P. Abramson, of Lancaster, is the new president of the Pennsylvania Water Works Operators Association. Other officers: George W. Naylor, of Punxsutawney, first vice-president; Rennie I. Dodd, Chester, vice-president, and I. M. Glace, Harrisburg, secretary-treasurer.

Lt. Col. Harrison P. Reed of Scarsdale, N. Y., has been named commander of Headquarters and Headquarters Company, 360th Engineer Construction Group, it was announced by Maj. Gen. Lawrence C. Jaynes, Commanding General, New York-New Jersey-Delaware Military District of First Army.

The 360th Engineer Construction Group is a New York Organized Reserve Corps Affiliated unit sponsored jointly by the Metropolitan Builders Association of New York City, the Associated General Contractors of America, Albany, N. Y., and the Building Contractors and Masons Builders Association of Albany.

Alan Griffith Stanford, vice-president of Robert and Co., Inc., Atlanta, Ga., has been elected president of the National Society of Professional Engineers to take office next Jan. 1, 1949, succeeding Alex Van Praag, Jr. of Decatur, Ill.

J. M. Broughton of Raleigh has been re-elected president of the North Carolina Engineering Foundation. Other officers re-elected for the coming year are: Harry H. Straus of Brevard, vice-president; R. D. Beam of Raleigh, secretary; and J. G. Vann of Raleigh, treasurer. Named to the executive committee were David Clark of Charlotte, John W. Clarke of Greensboro, James M. Peden of Raleigh, William Muirhead of Durham, K. Clyde Council of Wananish, and Clyde A. Dillon of Raleigh. L. V. Sutton and LeRoy Martin, both of Raleigh, were named alternate members of the committee. An investment committee to be composed of Broughton, R. M. Hanes of Winston-Salem, and R. S. Dickson, of Charlotte,

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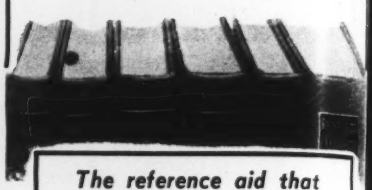

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also was set up. Total contributions to the foundation now amount to $268,404.57, and three professorships are being maintained at North Carolina State College. Chief aim of the organization is to promote the research and educational programs of the college's school of engineering. Funds donated to the foundation are used in supplementing the state salary scale in attracting top-ranking teachers for the school of engineering.

New England Sewage Works Association has elected the following officers: President, Walter H. Brown, Jr., Cranston; vice-presidents, Ralph W. Horne, Boston, Mass.; and William S. Wise, Hartford, Conn.; directors, Thomas A. Berrigan, Boston; Professor Edward S. Brown, Dartmouth College, Hanover, N. H.; and John R. Szymanski, New Britain, Conn.; and secretary-treasurer, Walter E. Merrill, Boston. Mr. Brown succeeds Leroy W. Van Kleeck, Hartford, as president.

Charles E. Petteys, Weston, has been elected chairman of the Ohio Committee of the Tri-State Soil and Water Council of the Maumee Valley. Other officers are C. E. Drury, Van Wert, vice-chairman; and Willard Farnsworth, Waterville, secretary. Thus far, the tri-state committee is composed of representatives from 15 counties in Ohio, five in Indiana, and three in Michigan. The group was organized to study the problems of soil conservation, drainage, and pollution in the drainage area served by the Maumee River.

E. L. Wales, head of the testing division of the Arkansas highway department, has been elected president of the Arkansas Society of Professional Engineers. Other officers are: Harold Engstrom of the Arkansas Foundry Co. and Victor C. Anderson of the Capital Steel Co., vice-presidents, and Beverly Ryan, engineer at the Little Rock waterworks, secretary-treasurer. Directors are: W. R. Spencer of the University of Arkansas, District 1, and George Swilley of El Dorado, District 3.

Governor Beauford H. Jester of Texas has appointed the following to be members of the Central Colorado River Authority Board: Cal Averett of Coleman, succeeding Arthur Young, deceased; W. T. Stewardson of Santa Anna, succeeding E. L. Knox of Coleman; R. G. Hollingsworth of Coleman, reappointed; and Clyde Thate of Burkett, succeeding W. J. Stevens of Coleman. All will serve a term of nearly five years except Averett whose term will expire the first of the year.

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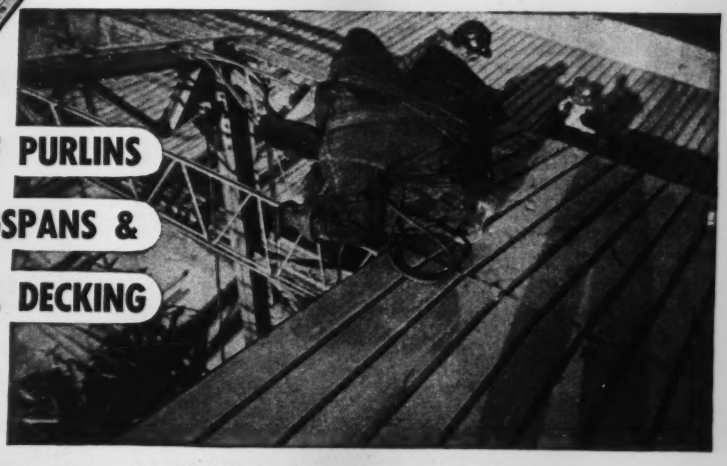

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Ark., Hot Springs—City, City Hall, exten. WW sys. **$785,000.**

Calif., Brawley — City Council, addn. and imprvs., to water sys., storage facilities, treatment plant and watermains **$750,000.** Quenton Eng. 816 S. Figueroa St., engrs.

Calif., Eureka—City, City Hall, water plant and distr. lines and reservoir. **$950,300.** Koebig & Koebig, Rowan Bldg., Los Angeles, engrs. CD 2/8/45—ENR 2/22/45.

Mass., Fall River—City, M. R. Daly, Water Dpt., Bedford St., two 1,000 g.p.m. electric pumps, 1 story, booster station, Howe and S. Main Sts. Creer Kent Mather Cruise & Aldrich, 423 Industrial Trust Bldg., Providence, R. I., consult. engrs.

Miss., Batesville—Town, approved bonds, WW improvs., **$100,000.**

Miss., Jackson—City, approved bonds, WW imprvs. **$500,000,** CD 8/17.

Ore., Dallas — City, City Hall, bond election November 2, 3 m.g. reservoir. **$175,000.** John W. Cunningham & Assoc., Spalding Bldg., Portland, consult. engrs. CD 2/27/46—ENR 3/21/46.

●**Tex., Houston** — Harris Water Control & Imprvt. Dist. 13, Courthouse, WW sys. **$5,500,000.** John C. Calhoun, Houston Merchants Exchange Bldg., consult. engr. CD 10/9/46—ENR 10/31/46.

Tex., Pear Ridge (P.O. Port Arthur)—City, voted bonds, WW, **$150,000.**

Tex., Stephenville—City, R. N. Pittman, mayor, voted bonds, 500,000 gal. overhead steel storage tank and 300,000 gal. underground storage tank, **$185,000;** c.i. waterlines, **$100,000.** CD 8/27.

SEWERS, WASTE DISPOSAL

PROPOSED WORK

Calif., Alhambra — City, municipal incinerator, **$250,000.** Taylor & Taylor, 725 S. Spring St., engrs. CD 5/7/47—ENR 5/29/47.

Calif., Elk Grove—Elk Grove Sanitary Dist., voted **$175,000** bonds, sewage treatment plant.

Calif., Eureka—City, City Hall, sewage treatment plants, **$679,600,** replacement trunk lines and mains, **$133,400.** Koebig & Koebig, Rowan Bldg., Los Angeles, engrs.

Calif., Hayward—City, City City Hall, voted **$160,000** bonds, sewerage sys. CD 2/26/47—ENR 3/20/47.

Calif., Los Angeles—Bd. Supervs. Los Angeles Co., 501 Hall of Records, storm drain, Broadway Drainage Sys., **$291,700,** storm drain, Lomita Blvd. Drainage Sys., Lomita, **$687,300.** C. E. Arnold, 205 S. Bway., co. engr.

Calif., Los Angeles—Bd. Supervs., Los Angeles Co., 501 Hall of Records, sanitary sewers in Maroposa St., C. I. 1271, and in Woodbury Rd., C. I. 1270, Altadena. **$137,000** each. C. E. Arnold, 205 S. Broadway, co. surv. and engr.

Colo., Denver—Mountaire Progressive Assn., c/o Ripple & Howe, 710 Colorado Bldg., sanitary sewerage sys. east of Sheridan Blvd. between W. 7 and W. 20 Aves. as far west as Kendall. **$100,000.** Ripple & Howe, 710 Colorado Bldg., archts. and engrs.

Mich., Marquette—City, 6 mg. d.c. sewage disposal plant, intercepting sewers, etc. **$300,000.** Shoecraft, McNamee & Porter, 306 State Savings Bank Bldg., Ann Arbor, consult., engrs. J. D. Clulo, Marquette, city engr. CD 9/21/44—ENR 10/5/44.

●**N. Y., New Rochelle**—City, E. T. Cranch, dir. P. Wks., City Hall, sewage disposal works, Lefevre Lane in Echo Manor Area, **$4,000,000.**

O., Middletown—City, **$275,000** bond election Nov. 2, incinerator plant.

Ore., Beaverton — City, City Hall, voted bonds, treatment plant, sewer sys. **$350,000.** Cunningham & Assoc., Spalding Bldg., Portland, consult engrs. CD 8/12.

●**Tex., Houston**—Harris Water Control & Imprvt. Dist. 13, Courthouse, sanitary and storm sewerage sys. **$6,000,000.** John C. Calhoun, Houston Merchants Exchange Bldg., consult. engr.

Tex., Stephenville—City, R. N. Pittman, mayor, voted bonds, sanitary sewer line extens., **$200,000;** sewage disposal plant, **$100,000.** CD 8/27.

B. C., Burnaby — Municipality, Municipal Hall, sewer facilities for 600 homes in Willingdon Area. **$125,000.**

BRIDGES

PROPOSED WORK

Massachusetts—Metropolitan Dist. Comm., 20 Somerset St., Boston, Elliot Bridge above Laz-Anderson Bridge over Charles River, Cambridge and Boston area, Middlesex and Suffolk Counties. Over **$500,000.** Burns & Kenerson, Inc., 20 Kilby St., Boston, engrs.

●**New York**—State Bridge Authority, Alfred E Smith Bldg., Albany 1, bridge over Hudson River (3 lanes, 45 ft. wide suspension bridge, 1,700 ft. main span, 6,960 ft. overall length) from Kingston to Rhinecliff. **$14,000,000.** D. B. Steinman, 117 Liberty St., New York, Zone 6, consult. engr. CD 7/22/47—ENR 8/7/47.

Pennsylvania — State Hy. Dpt., Harrisburg, constructing overpass carrying T. R. 31 over Pennsylvania R. R. track in Somerset Twp., constructing grade crossing where proposed ramp from that Route to St. Hy. Route 118 will cross Pennsylvania R. R. spur track in Bentleyville Boro. Washington Co. **$400,000.** E. L. Schmidt, c/o owner, ch. engr.

●**Washington** — State Toll Bridge Auth., Olympia, reconstructing approaches to bridge over Columbia River, city of Longview, Cowlitz Co. **$1,400,000.** C. E. Andrew, c/o owner, ch. engr.

Wash., Seattle — Port of Seattle, Bell St. Terminal, Zone 1, bond election November 2, viaduct from Ballard Bridge into Port of Seattle property at Salmon Bay. **$250,000.** G. T. Treadwell, ch. engr. CD 12/1—ENR 12/11.

●**Wash., Tacoma**—City, City Hall, bond election Nov. 2, steel, concrete approach to E. 11 St. bridge over City waterway, **$700,000;** overcrossing on East D St. from E. 25 St. north 1,275 ft. over Puyallup Ave. and railroad tracks, **$400,000,** R. E. Morris, City engr. CD 8/12—ENR 9/2.

Wash., Tacoma—Pierce Co., County Courthouse, bridge over Stuck River on Williams county road north of Sumner, replacing structure which collapsed, **$100,000,** Finch Van Slyke, co. engr. Homer Hadley, Seaboard Bldg., Seattle, Zone 1, consult. engr. CD 7/1—ENR 9/22.

Quebec—Dpt. P. Wks., P. O. Bldg., Quebec City, bridge St. Cesaire. Approx. **$112,000.**

STREETS AND ROADS

PROPOSED WORK

Calif., Redwood City—Rds. City, City Hall, imprv. streets in South Kensington Sq. Over **$200,000.** Glenn Jain, city engr.

Idaho, Boise — City, City Hall, 1 mi. extens. of 16 St. to Crescent Rim Dist., **$175,000.** J. L. Morris, Boise, city engr.

Miss., Meridian—City, defeated bonds, street imprvs. **$250,000.** CD 8/12.

Wash., Kirkland — City, City Hall, curbs, gutters, sidewalks on Market St. etc. **$310,000.** H. H. Sisler, city engr. CD 7/20/45—ENR 8/2/45.

Wash., Tacoma—City, City Hall, bond election Nov. 2, cut-off from 6 Ave. to Center St., with grade separations at S. 12 St. and Orchard St., **$500,000;** exten. Milwaukee Way, **$155,000;** imprv. Cedar St., **$65,000,** R. E. Morris, city engr. CD 8/12—ENR 9/2.

EARTHWORK, WATERWAYS

PROPOSED WORK

†**Maryland**—U. S. Eng., 24 St. Maryland Ave., P. O. Box 1715, Baltimore, Zone 3, test piles in Chesapeake Bay between Sandy Point, Anne Arundel Co. and Kent Island, Queen Annes Co.

●**B. C., Vancouver** — Fraser Valley Dyking Bd., 123 W. Pender St., light clay and sandy loam dyke reconstruction, **$5,000,000** to **$6,000,000.** CD 9/28/43—ENR 9/30/43.

AIRPORTS AND AIRBASES

PROPOSED WORK

Mo., St. Joseph—AIRPORT BLDGS.—City Aviation Bd., plans by Everett Johns, Empire Trust Bldg., administration and terminal bldg. at Rosecrans Field, **$200,000.** CD 9/2—ENR 9/18.

S. D., Aberdeen—AIRPORT—City, airport, **$209,500,** CAA. J. F. Buck, city engr. CD 12/20/45—ENR 1/10/46.

S. D., Watertown—AIRPORT—City, airport, **$107,547,** CAA. W. H. Emerson, city engr.

Tex., Fort Worth—AIRPORT—City, W. O. Jones, mgr., grading, draining at Greater Fort Worth International Airport. 15 mi. east of here. **$880,000.** Wyatt C. Hedrick Co., 1005 First Natl. Bank Bldg., consult. engr. CD 1/17/45—ENR 3/22/45.

Que., Drummondville—AIRPORT—City, M Marier, clk., municipal airport, Approx **$150,000.**

LATIN AMERICA

British West Indies, Saint Vincent—Colonial Govt., Saint Vincent, water supply, **$200,000.**

British West Indies, Saint Vincent—Colonial Govt., Saint Vincent, hydro-electric plant, **$400,000.**

Mexico, Merida—Yucatan State Govt., Palacio del Estado, Merida, Yucatan, plans leper sanatorium, **$500,000.**

Mexico, Mexico City—Mexico City Lyons Club, Miguel Abed, I. la Catolica, 45-7-4, Mexico, D. F., plans clubhouse, **$400,000.**

PUBLIC BUILDINGS

PROPOSED WORK

Ark., Little Rock—State Bd. Educ. plans by Trapp & Clippard, Pyramid Bldg., 4 story stone office bldg. **$250,000.**

●**Calif., Berkeley**—Bd. Educ., 1414 Walnut St., **$8,000,000** bond election Nov. 2, schools. CD 11/11/46—ENR 11/28/46.

●**Calif., San Francisco**—City, Dpt. P. Wks., City Hall, **$48,890,000** bond election, Nov. 2, schools, Dodge A. Riedy, City Hall, city archt. CD 6/10—ENR 6/17.

●**Calif., San Francisco**—Dpt. P. Wks., City Hall, **$15,000,000** bond election Nov. 2 convention hall; **$6,000,000** bonds, Hall of Justice, Dodge A. Riedy, City Hall, city archt. CD 6/26—ENR 7/8.

Calif., San Jose—Santa Clara Co., Courthouse, San Jose, plans by Ralph Wyckoff, Santa Clara and Market Sts., jail. Over **$25,000.** CD 4/27/44—ENR 6/18/44.

Conn., Wilton—Town, N. S. Hurlburt, chn. bldg. Comm., Wilton, plans by Kilham & Connors, 101 Park Ave., New York, N. Y., 2 story bsmnt., brick, steel high school. **$600,000.** CD 2/14/45—ENR 3/8/45.

Ill., Metropolis—Massac County Hospital Authority, W. R. Liggett, chn., Bd. Commrs., Metropolis, plans by McCoy & Wilson, Mount Vernon, 54-bed rein.-con., brick, hospital. Approx. **$500,000.** CD 7/16—ENR 7/29.

Ky., Owensboro—Daviess Co. Bd. Educ., rebuilding West Louisville School, **$250,000.**

La., Jena—Town, bond election Oct. 5, electric power plant, **$150,000.** CD 6/6/46—ENR 7/11/46.

●**La., Shreveport**—City, City Hall, plans by Samuel G. Weiner, Neild & Somdal & Van Os & Flaxman, Commercial National Bank Bldg., hospital. **$8,000,000.**

Mass., Amherst—Commonwealth of Mass., University of Mass., Amherst, plans by Appleton & Stearns, 53 State St., Boston, electrical engineering wing of main engineering bldg. **$400,000.**

Mass., Arlington—School Dpt., Town of Arlington, plans by Thomas Worcester Inc., 84 State St., Boston, gym and auditorium alterations, approx., **$250,000.**

Mass., Brookline—Town, Supt. Schools, plans by Kilham, Hopkins, Greeley & Brodie, 126 Newbury St., Boston, high school addn., North Wing gymnasium, **$750,000.**

Mass., Dedham—Town, Veterans Housing Authority, Town Hall, 80 dwelling units for veterans housing. Approx. **$750,000.**

●**Mass., Holyoke**—City, Housing Bd., City Hall, 219 dwelling units, Cherry Sts. **$2,000,000.**

Mass., Leominster—Town, Veterans Housing Authority, Leominster, 73 dwelling units for veterans, Viscoloid Ave. between Leominster and Lancaster Sts. Approx. **$700,000.**

Mass., Newton—City of Newton, plans by Frank H. Colony, 110 Plymouth Rd., Oak Hill Fire Station, **$300,000.**

●**Mass., Newton**—City-Bldg. Comm., plans by Shepard & Stearns, 65 Franklin St., Boston, Williams School, **$350,000-$400,000;** plans by Frederic C. Stearns, 340 Wolcot St., Williams School Grammar, Auburndale, **$400,000,** plans by Maurice B. Biscoe, 595 Boylston St., Oak Hill School, **$250,000.**

Mass., Norton—Town, School Dept., plans by Giles Smith, 67 Leonard St., Belmont, two 2 story, bsmnt., 60x110 ft., fireproof 10-room schools connected by Community Hall, **$350,000-$500,000.** CD 8/22/46—ENR 9/5/46.

Minn., Minneapolis—Municipal Bldg. Comm., City Hall, plans by A. M. Larson, City Engr. Dpt., City Hall, reroofing city hall and court house bldg. **$280,000.**

Mo., Maryville—Northwest Missouri State College, Maryville, plans by Walter Boschen & Curzon Kinder, 517½ Francis St., St. Joseph, 2 story, bsmnt., 110x180 ft., brick, steel students service bldg. **$560,000.**

Mont., Malta—Phillips Co., Malta, plans by Corwin & Co., Fairgrounds Admin. Bldg., Great Falls, hospital, **$262,000.**

N. J., Palmyra—Bd. Educ., preliminary plans by Micklewright & Mountford, 242 Hanover St., Trenton, school. **$400,000.** CD 10/11/46—ENR 11/14/46.

N. M., Clovis—Curry Co., The Bi-State Fair Assn., Clovis fair plant, incl. dairy bldg., grand stand, rodeo grounds, race track, etc. **$100,000.**